Australian
Personal
Computer

ATARI'S NEW MICROS KNOCK 'EM DEAD!

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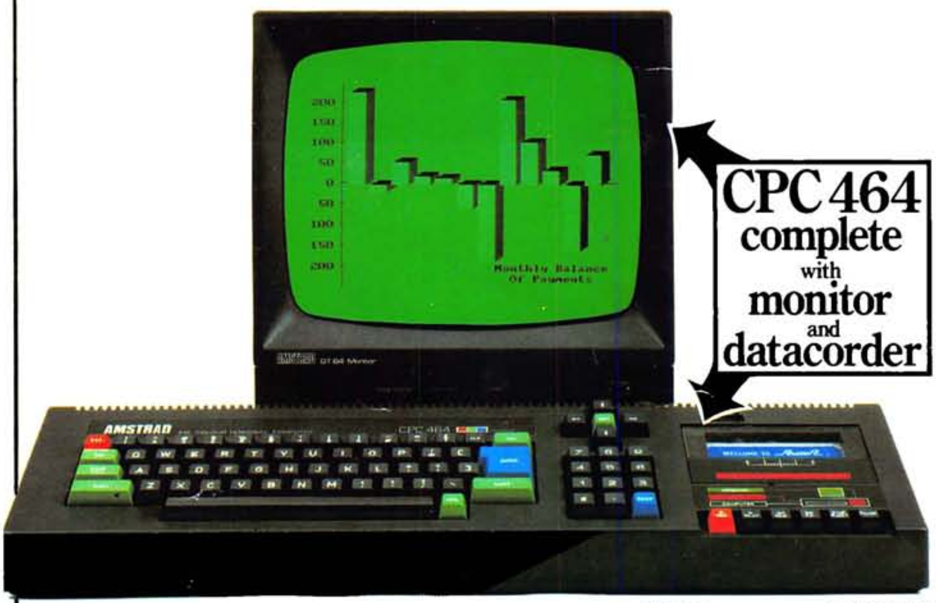
AUSTRALIA'S TOP SELLING COMPUTER MAGAZINE

DON'T PANIC! — 'Hitch-hiker's' arrives on disk

Amstrad's new CPC464 comes with plenty of free plugs.



CPC464 green screen VDU (GT64)

You may have noticed that the press has got very excited about our new computer system.

And rightly so.

Because the new CPC464 comes complete with its own green screen VDU or colour monitor, built-in cassette data recorder, 64K of RAM, 32K of ROM, typewriter style keyboard and a very fast extended BASIC.

When you consider that the complete computer system including green screen VDU and cassette data recorder hardly costs a fortune, that's plenty to get excited about.

You can use the green screen version of the CPC464 with a colour TV by connecting the optional power supply and modulator (MP-1).

> "I think the Amstrad will give a lot of sleepless nights to Sinclair, Acorn and Commodore..."
>
> POPULAR COMPUTING WEEKLY

Other micros can't get anywhere near the CPC464's memory for the price. Over 42K is available to users, thanks to the implementation of ROM overlay techniques.

Sophisticated and complex programs are easily accommodated.

And the CPC464 offers you high resolution graphics, 80 column text display, up to 8 text windows, a graphics window and a palette of 27 colours.

> "The CPC464... in two boxes and one lead includes a list of features that would shame a hybrid of the major machines."
>
> PERSONAL COMPUTER WORLD

One of the most obvious is the quality of the on-screen graphics. Quite simply, the CPC464 beats the micro/domestic TV combination out of sight.

That's because our monitor drives each colour on the screen directly from the computer. Nothing gets in the way of the best possible picture. And you won't have tuning problems, either.

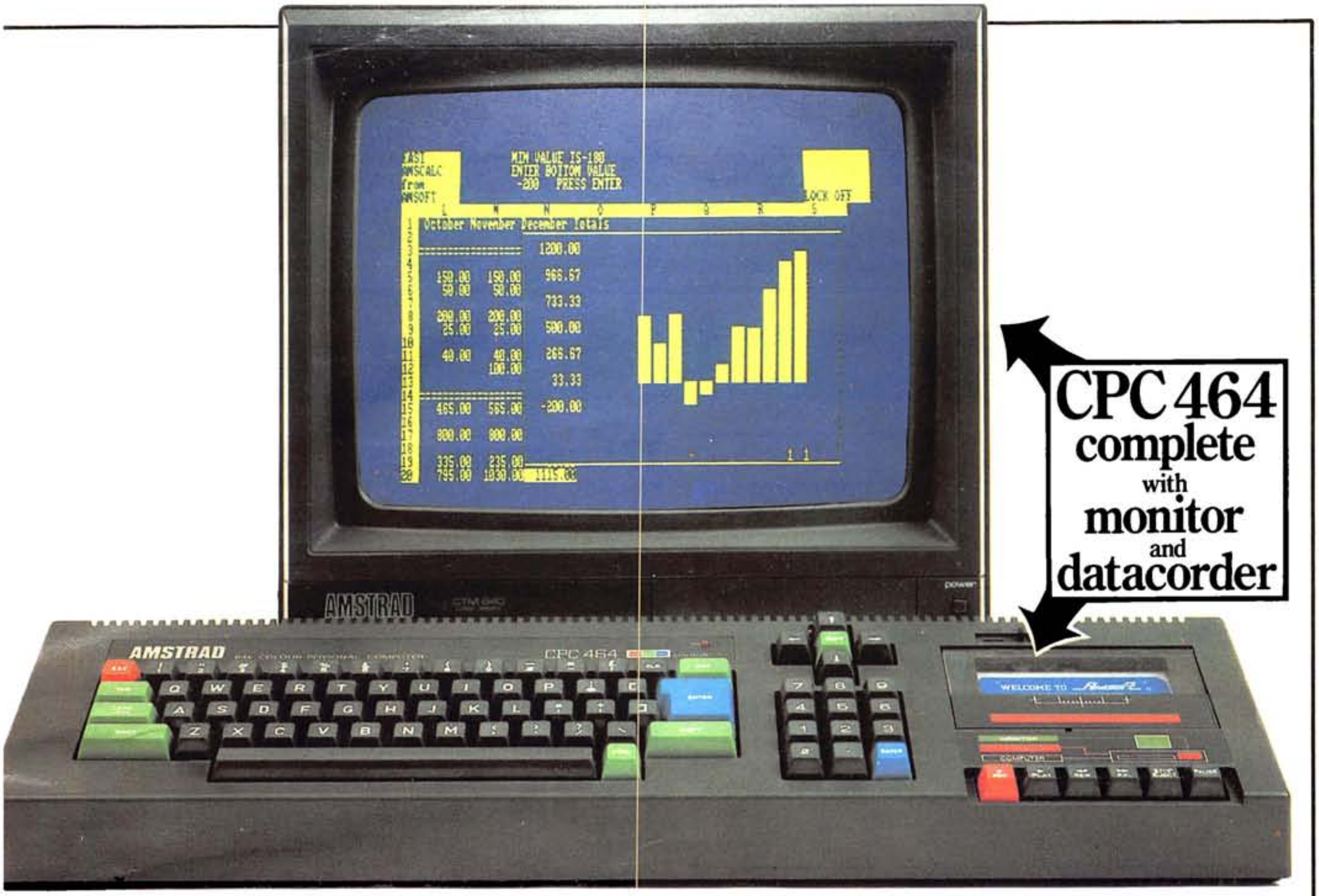
There's plenty of interest for music lovers when the 3-voice, 7-octave stereo output is fed through a hi-fi amplifier and speakers.

> "The Amstrad is a powerful, fast machine, with plenty of memory, easy to program..."
>
> PERSONAL COMPUTER WORLD

A fast growing range of Amsoft programs is already available.

The high quality software takes full

AD.
NO. 6



CPC464 complete with monitor and datacorder

dvantage of the CPC464's high pecification and speedloading capa- ility. Which means even complex rograms can be loaded quickly.

Arcade games, educational programs nd business applications are all esigned to utilise the CPC464's im- ressive graphics, sound and proces- ng abilities.

Amstrad. User Information Service.

Whether you're interested in serious ommercial applications or you're a ames fanatic you'll want to receive he latest information about your MSTRAD Computer. Upon request ou will be advised about the latest oftware and its application, special nformation concerning your CPC464, vailable peripherals and software eviews. There will also be programs nd exercises to try.

User Clubs.

In addition to the User Information Service you will be given details of where you may contact your nearest independent user club.

"The Amstrad machine provides a lot of other features for a very low price."

GUARDIAN

At Amstrad, we're constantly looking to the future. That's why the CPC464 has a built-in parallel printer interface. A low cost optional disk drive system including CP/M* (with the option to access 3000 programs) and LOGO. A joystick port. And the virtually unlimited potential of the Z80 data bus with sideways ROM support.

With so many free plugs from the press, it's little wonder the CPC464 only needs one.

Optional 80 column dot matrix printer DMP-1. Offers high performance computerised text processing

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*Trade mark Digital Research

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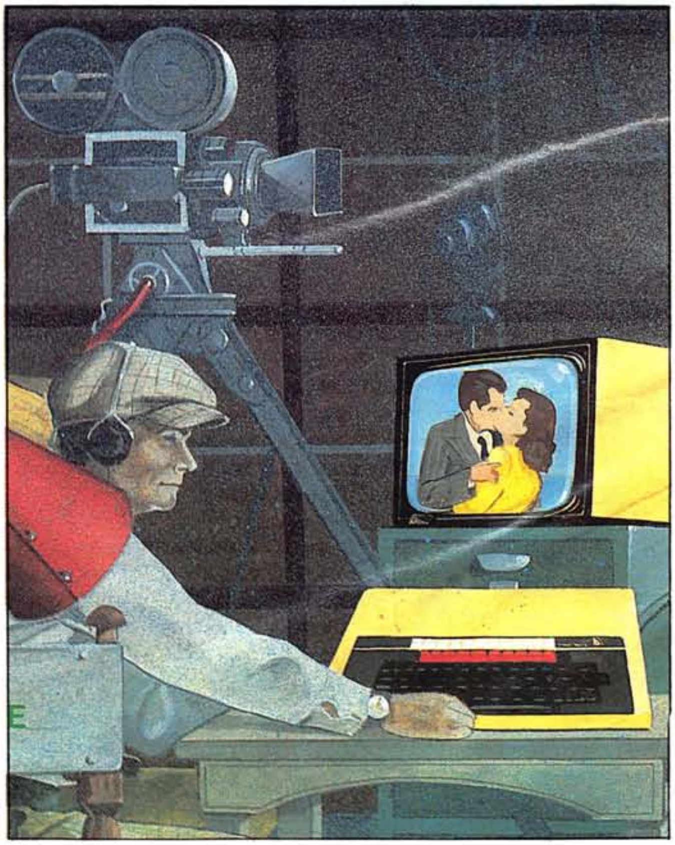

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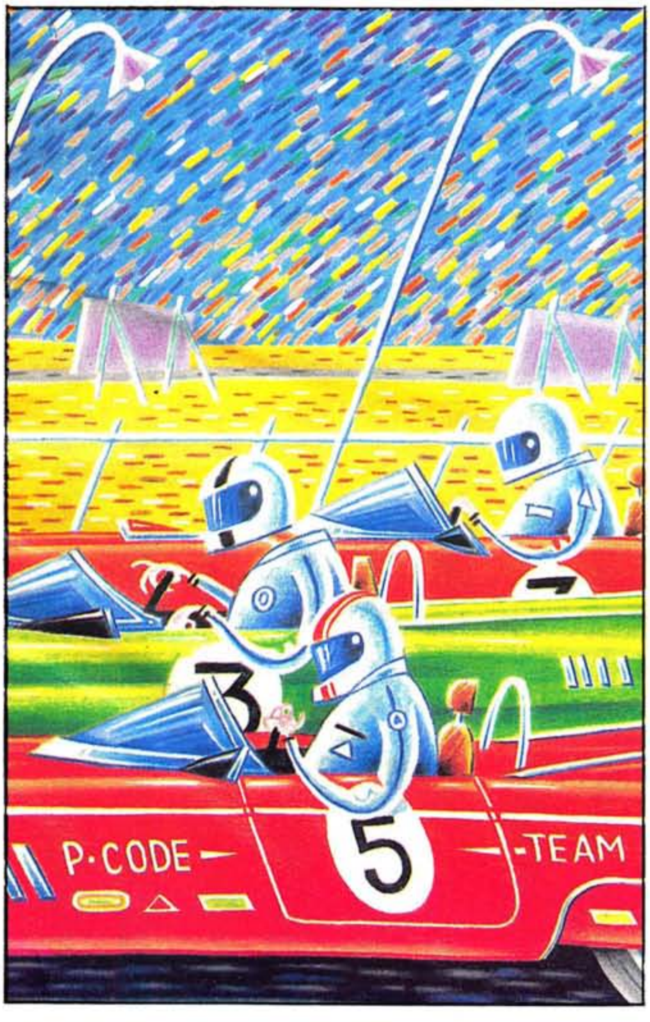

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Tallgrass' integrated tape backup – clearing the PC path.

Tallgrass Technologies' hard disk drives with integral cartridge tape backup. They offer serious users of PC's unmatched performance in mass storage, speed, and data integrity together with the highest capacity PC backup system available, integrated for simplicity, speed, and ease of use.

For the serious user, that's the direct path through the PC jungle.

MASS STORAGE. Tallgrass expands the capacity of your PC with hard disk drive/integral cartridge tape back systems in formatted capacities of 12-70 megabytes.

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DATA INTEGRITY. Tallgrass ensures data integrity with high level error checking and options including duplicate directory, 'read after write' verification, and a dedicated 'head landing' zone that precludes data loss during power downs.

BACKUP. Tallgrass' unique integral cartridge tape backup combines speed with high capacity to encourage reliable routine operator backup of your data.

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Since pioneering integral cartridge tape backup systems, Tallgrass has remained the US industry standard. For economy, ease of use, reliability, high speed loading and retrieval, and multisystem compatibility, Tallgrass is by far the best mass storage system on the market today.

Follow the Tallgrass path to your nearest Tallgrass Dealer and transform your personal computer into a powerful data processing system.

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Concurrency on the Mac; video disk games; Bell Labs 'super' algorithm; and Jack Tramiel's revitalised Atari dominates the recent CES show in the US . . . this month's Newsprint is more gripping than an Alistair MacLean thriller.

It's not really getting any less confusing

They are pretty pleased with themselves at Digital Research, where they reckon they've beaten IBM to the punch with a "proper" operating system for the AT.

Concurrent DOS 286, launched together with Intel (which makes the 80286 super chip inside the AT), does something that the AT's own operating systems, DOS 3.1 and Top View can't do.

That is, extend the memory beyond a megabyte.

The 80286 operates in three modes. At start-up, it behaves very like the original 8086 or 8088 inside the IBM PC. It addresses a megabyte, maximum, of internal memory, and it controls it in segments of no larger than 64k bytes.

But it can be switched to "protect" mode. In this mode, it suddenly can control 16 megabytes of memory — and the PC AT does have the necessary wires to plug all that memory in — and can give different programs different "privilege" levels.

The most privileged level, zero, is reserved for the operating system. It can decide which program runs in which part of the memory, and which bits of memory are not RAM any more, but ROM, or which bits can't even be read, because they are secret. No other program can change these protected segmentations.

The result is that computers like the AT and ICL's 286 based micros, and others (still secret) can now run multi-task, multi-user programs — and the users of the AT who stick with Top View and DOS 3.1, can't.

When the software is available from Digital Research in April, it will actually run DOS 2.0 programs, direct from the disks — at the moment, the company's latest version of Concurrent will read DOS 2.0 files, but not run programs.

Most IBM watchers now agree that Top View is more than just a "cosmetic overlay" to DOS, and is a genuine multi-tasking operating system.

But it doesn't have the multi-user, networking abilities of Concurrent DOS — and even stranger, all the evidence is that IBM doesn't propose to upgrade it to that level for several months — possibly, not until next year.

And strangest of all, it only gives the AT access to the 640k of memory that the PC has today. It doesn't use protected mode at all.

The only thing that is still far away on Digital Research's travel plan, is the networking parts of DOS 3.1. They say they hope to incorporate that this year, but not at the release of Concurrent 286. But they will announce DR Net in a version to work with Concurrent 286, in April.

Working with the already announced GEM, this new operating system could start the transformation of the AT into a super-Macintosh.

The segmentation and protection abilities of the 286 chip go some way beyond the powers of the 68000 chip as used inside the Macintosh, especially with the current Mac operating software.

However, there will be interesting annoucements on that level, in 1985, too. Concurrent DOS 68k is likely to be announced in the next few months, giving multitasking to many systems with the 68000. And a Mac version is one that Digital Research will find hard to resist.

Magnificent seven lead out by Atari

When the wreckage was cleared away and the bodies removed, the score at the recent Consumer Electronics Show in Las Vegas was Atari 5, Commodore 2.

'Business is War', says Atari boss Jack Tramiel, and his new-look corporation went for every jugular in sight, as its multiple product launch stopped the show. Commodore hit back, but was beaten for panache, scope, and sheer nerve. The rest were nowhere.

The Atari slogan at Las Vegas was 'Power without the Price'. When the dust settles and the machines get the chance to prove themselves, we'll know about the power; but the prices are amazing. On paper Atari has killed off the Macintosh and any number of mid-range micros in one fell swoop.

That's on paper. Coleco made a splash along the same lines at the same show two years ago, and in the end it couldn't deliver. Atari's machines look far more ambitious, but with Tramiel involved anything could happen.

As he'd promised before Christmas, Atari had complete families on show at Las Vegas. The XE line of 8-bit systems are direct descendants of the 800XL; the ST twins break new ground for Atari with Motorola 68000 processors. For good measure there were also new peripherals and some startling software.

From the bottom: the 65XE is an 800XL with a face-lift, but the differences aren't all superficial. The XE range has rejigged circuitry, with the result that they are visibly faster than the 800XL and reputedly more reliable. The 65XE will cost about $120 in the US.

The 65XEM adds a music synthesiser to the basic

XEP — new-look Atari packaging around 800XL compatibility.

design — its price will be under $US160. The 65XEP is a luggable version of the 65XE, with a built-in 3.5in floppy drive and a 5in monochrome monitor, for about $US400.

At the top of the XE range is the 130XE, with 128k to the 64k of the others. This machine will reach US shops later this year with a price tag of about $US200. Like the others, it's driven by a 6502 with a new version of Atari DOS. Owners of the 800XL are promised an upgrade from their DOS 3.0 to the new version, and Atari is claiming compatibility with all 800XL software for the new systems.

The XE range looked good in its own right, but it turned out to be just an appetiser before the main course — the 130ST and the 520ST. Both machines run a 68000 processor with a proprietary operating system that is still called TOS (Tramiel Operating System). Anybody who thought that this might be a temporary name while something more suitable was devised looks like being disappointed. Tramiel seems to be making a bid for immortality in more ways than one.

TOS incorporates Digital Research's GEM. That means mice, windows, icons, handsome graphics, the whole Macintosh kit and caboodle. Wags around Las Vegas were calling the machines Jackintoshes. With 128k and 512k they will cost $US399 and $US699 respectively.

Apple executives will find it hard to hide the lump in their throats and IBM will refuse to comment, since it never acknowledges competition.

The crucial feature will be software. Atari demonstrated an impressive package called Infinity on the XE range, but applications for the STs will depend on how well software suppliers respond to TOS. Infinity is a combination of spreadsheet, word processor and relational database with on-line help, windows, and a shared command structure, described by an observer as 'jazzy'.

GEM (and CP/M-68k) are implemented in ROM on the STs, but for old time's sake Tramiel also launched a disk drive. Like everything else, its price is breathtaking — 500k on a 3.5in drive for $US100. It can be hooked up to any of the new systems, EX and ST alike. A 3.5in hard disk is due to follow shortly, offering 10Mb. Shell-shocked industry analysts wouldn't speculate on what the price tag on 10Mb might be.

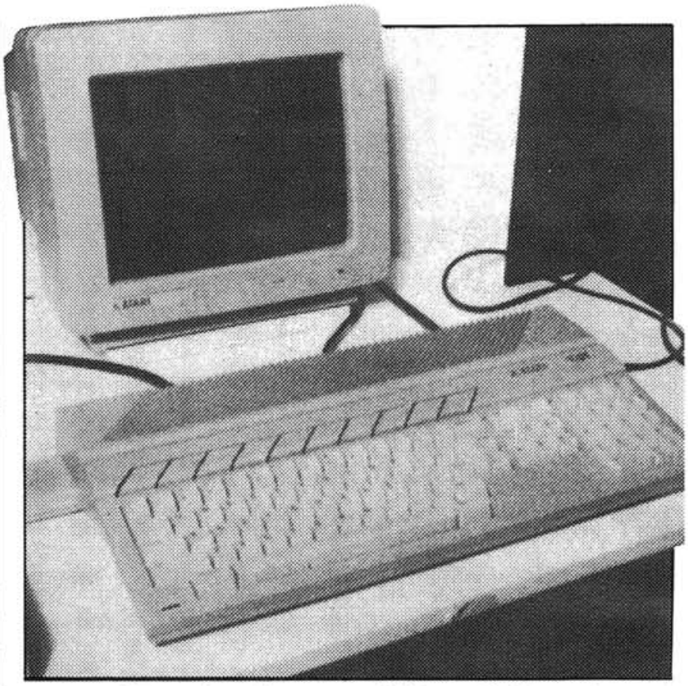
Atari demonstrated a trio of printers in the $US50 to $US100 range. There was a thermal colour printer, an impact dot-matrix unit, and a daisywheel. The company said that these devices were compatible with current Apple and IBM machines, and you got the impression that Atari was on the offensive even here.

The other 1,399 or so exhibitors could only look on in awe. Atari's new systems should start appearing in the US in the spring. But Commodore clawed back some of the attention with a couple of releases of its own. At any normal show it might have made the headlines.

The C128 proved to look completely unlike any previous Commodore system, and the company has broken with another tradition by making it compatible with the 64. But, elegant as it was, it paled beside the clumsily named Commodore LCD.

This is a portable in the tradition of the Tandy Model 100: it tips the scales at 3lbs,carries 32k of RAM, and has basic business software built-in. The LCD name refers, of course, to its screen, an 80 by 32 display. Power is from standard batteries or, through an adaptor cord, from the mains. It is expected to cost about $US500.

The C128 appeared with a trim half-height 360k disk drive, and the layout on Commodore's vast display area was calculated to appeal to business users as well as home micro fans. The system has the dimensions of an Apple IIc, and a keyboard with clusters of keys all over the place.

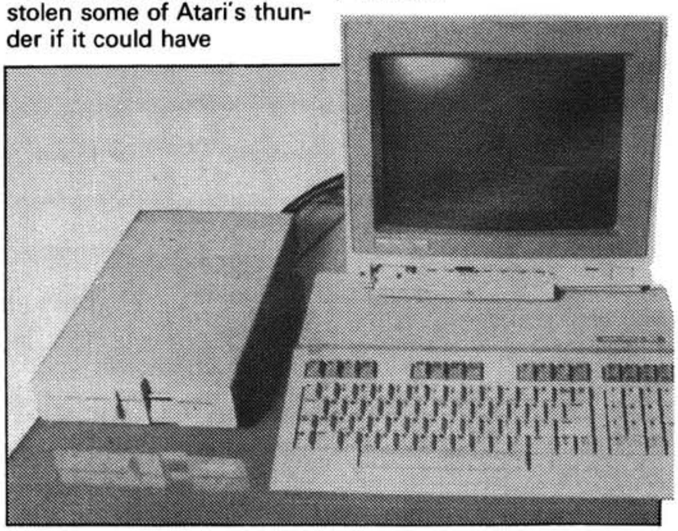


Atari 130ST — what price a tatty old Mac with this on the way?

Will the C128 put pressure on the Plus/4? Its price is likely to be about $US250; its 128k can be built up to 512k and it holds out the rather vague promise of 'CP/M- compatibility'. In any other context this would look very attractive; but at CES, with Atari running amok, the Plus/4 looks irrelevant.

Commodore might have stolen some of Atari's thunder if it could have demonstrated the Amiga machine — or it might have risked having the system submerged before it has a chance to make an impact.

In the world's most famous gambling city Jack Tramiel was in his element. The most awe-inspiring feature of Atari's performance at CES is that the new machines are the first to be released under his leadership — it was far from being the last desperate throw of a cornered man. There are more on the way: 32-bit systems due to be demonstrated in a few months.



Commodore's 128 plus business additions — a Plus/4 killer?

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Dear business-person,

It was Lotus 1-2-3 in 1983
dBASE III in 1984
and now SAMNA III in 1985.

This SAMNA word processing software is so good that it is winning hands down, in the U.S., against dedicated word processors, as well as WordStar and Multimate.

Among the long list of advanced features is real proportional spacing and the ability to read documents from other machines.

It works on the IBM PC (and close compatibles), the AT, PC 3270, the TI Professional and DEC Rainbow.

There's a SAMNA PLUS version, as well, which has an integrated spreadsheet and list manager.

See them both demonstrated at the 4th Personal Computer Show, Centre Point, Sydney on March 13-16. Other exciting new products you'll see are:-

Three dimensional spreadsheets from INTE.
GEM from Digital Research.
The new hard disk versions of Framework and dBASE III.

You'll also see Version 2 of SuperCalc3; Presentation Master and Concurrent PC-DOS.

Yours faithfully,

MJL.

Vice President in charge of Soliciting

P.S. If you can't make the PC Show, hassle your local Computer Shop for a demo. Or contact us directly.

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According to Tramiel, he spent a lot of last year touring Atari's manufacturing plants and building up capacity. If the market responds to his new machines in the way you'd expect, the company will need every last inch of production line to meet demand.

Unix on thin ice

"If IBM continues to back MS-DOS as its primary operating system, and if that operating system is enhanced to gradually include a sophisticated degree of multi-tasking, then that'll be the end of Unix, at least as far as the PC world is concerned," commented a pundit in Los Angeles recently.

The pundit is my old friend David Ferris, head of Ferrin, a company which trains corporate users of microcomputers and advises on selection of hardware and software. And apart from his split infinitive (a grammatical term from a few decades ago) I couldn't have put it better myself.

Ferris and his colleagues do believe that there is a major requirement for "a good standard multi-tasking operating system for personal computers." They don't think Unix is the one.

To cap it all, the firm is unimpressed by the Unix ability to put several users on one PC ("Just a waste of time," they said) and is warning corporate clients to steer clear of Unix for software reasons, too. "The software for business use just isn't good enough," said Ferris.

Guy Kewney

When at first you don't succeed

Now that Coleco has killed off its Adam microcomputer, we will never know whether it failed because the design didn't appeal to enough people or because they never managed to build any that worked.

However, the company (now concentrating on cabbage patch dolls) does still have a computer product up its sleeve — a phone which runs Apple II software.

The plan is to sell this for $750, but the plan isn't Coleco's. That company hopes to find a sucker — sorry, buyer — to take over the design.

Guy Kewney

Sending the MSX menace packing

by Serge Powell in Japan

Japan over Christmas and the New Year should be a home computer owner's dream: most companies shut down from noon on December 28, not to open again until January 4. This year my company extended that to January 7, thereby providing an abundance of time for personal computing. So why is it that I feel I'd rather have gone to the office?

The reason is MSX, which has invaded my home. Yes, we're a two-computer family, and if my experience is anything to go by, there should be an adventure game on the pitfalls of introducing a games-type computer into the home.

In Japan at the moment there are two classes of citizen: the proud, patriotic, upstanding type who buys an MSX micro and glories in it; and the neo-Luddite who skulks in dark corners avoiding the ladies who press white feathers into his clammy palms. Under these circumstances I hardly had a choice.

You may have read that MSX isn't going down too well in its native land, but like everything else you read in the papers (well, almost everything — we still strive for excellence in some quarters), you ought to take this with a pinch of salt. From all appearances MSX is gathering strength all the time, and there is excited talk of MSX II, which is supposed to be just around the corner.

Meanwhile the prices are attractive and they're becoming more so all the time. There is an element of the pools about all this, or, to borrow a slogan from the national Australian lottery, 'You're got to be in it to win it'.

There is a standing rule here that my kids can watch television for 30 minutes of their choice every day. If my wife wants to watch something, they're welcome to join her. In some mysterious fashion, they have worked out a schedule of programs they've all agreed to watch, but when my daughter missed her favourite show because her eldest brother had the MSX machine linked to the set, the *entente cordiale* became the *enfant terrible*. I don't know where she learned the language she used, but MSX gained another enemy in the house.

Then my wife got involved with a game called *Clapton II* (nothing to do with the cream of blues guitarists). It's my solemn belief that nothing should come between a man and a hot cup of tea — now it seems that my demure Japanese wife would rather blast objects in space than put the kettle on to boil.

And naturally, as I'd expected, my seven-year-old son takes great delight in embarrassing me at a game called *Pair-Pair*, in which the object is to match hidden pairs of fruit, vegetables and animals while avoiding being gobbled up by little black things that wander about the screen. Not only has he managed to embarrass me in front of his friends, but on one occasion in front of mine.

In desperation I turned to my own machine for the companionship and solace that old friends are said to offer. Ha! A simple act like updating my mailing list on *dBase II* turned into an act of contrition, with a dozen or so letters aimed at various destinations around the globe. Looking on the bright side, I'd again managed to avoid writing the accounts receivable and invoicing program I'd been meaning to set up to keep track of my free-lance work.

Not that I get to do too much of that. I'm the only writer at the office with a word processor at home, so guess who got to bring home an urgent project. Working at the office with only the telephone for interruptions is one thing, but working at home with three children, a wife, and an MSX computer with ear-shattering sound effects, each trying to outdo the other, is a situation no writer should have to endure.

So I didn't. For all their faults, MSX systems are lightweight and compact. They pack easily into the boot of a car, and hook up just as easily to grandparents' television as they do to chez Powell.

So it was with great pleasure that I stood in the driveway waving goodbye to my wife and kids as they headed off in the direction of the grandparents. I must confess I even uttered a slightly vindictive chortle as I remembered that the most audible irritant among the accompanying ROM packs had been a Christmas present from their grandfather.

Until I remembered that, although it does many things well, I've yet to figure out how to teach my trusty NEC to make a proper cup of tea. Naturally I blame that on MSX as well — wouldn't you?

Still in flight

Eagle has side-stepped the

...other computers cringe

PortaPak comes with its sleeves rolled up. It was designed in Australia to get the most work done in the least time and at the lowest price.

If you want results, sheer computing power, trouble free performance, then PortaPak is the only choice. If you want prestige, if you need to stroke your corporate ego, we suggest you buy something else. Something that costs more, isn't as powerful but has a lot of "image."

Put PortaPak up against imported machines costing $5000, $6000 even $7000. The other machines cringe with embarrassment.

PortaPak has 800K of formatted space on each disk drive. The expensive machines which boast about having 360K suddenly look rather silly. With PortaPak you'll be able to handle much bigger data files and have far more programs on hand without having to fiddle around changing disks.

Reliability is often thought of in terms of machine breakdowns. Nowadays, the big problem isn't with breakdowns it's with hangups - when your machine turns out to be incompatible with your software. This is an enormous, widespread problem.

It's why we teamed up with Australia's software geniuses - Software Source Pty Ltd, the top suppliers of business and professional programs in the country. First, they specially customized PortaPak's operating system so it works with exceptional speed and simplicity.

Then they customized all their CP/M products to run perfectly on the PortaPak - products like dBASE II, SuperCalc, all the major languages, accounting systems, etc. Most importantly, they stake their reputation that all these products will work without hitches. No other computer in Australia can offer this total software support.

As for electrical and mechanical reliability, look inside a PortaPak. There's a striking difference. The PortaPak is completely modular. We didn't scrimp by putting all the circuits on one board. We use *three*. Servicing is simpler, quicker and cheaper. It's why the leading national computer service company, TCG Pty Ltd, is pleased to offer a 12 month service contract on PortaPak in all capital cities.

Take an extra close look at the Canon disk drives. If Rolls-Royce built computers, they'd use Canon drives. See the massive head protection shield? Hear the way the heads lock away every time they deselect? The designers had an unusual attitude to reliability - fanatical.

Now carry out some speed tests. On a standard benchmark test using BASIC routines*, the timings are: PortaPak 12.9 seconds, IBM PC 16.4 seconds, NEC APC 19.7 seconds and Sirius 16.4 seconds. Using a standard dBASE II routine**, the timings are: PortaPak 8 minutes 11 seconds, IBM PC 11m 52s, Sirius 17m 9s and NEC APC 19m 16s.

The expensive imports really cringe at this because they make so much of being "16-bit" machines. PortaPak is an 8-bit machine and proud of it. Not only is an 8-bit machine inherently better suited to jobs like word processing, accounting, spreadsheets, etc, but the 6MHz clock rate ensures it can run rings around the others even in complicated mathematical tasks.

Now to really rub it in, look at PortaPak's stunning additional features:

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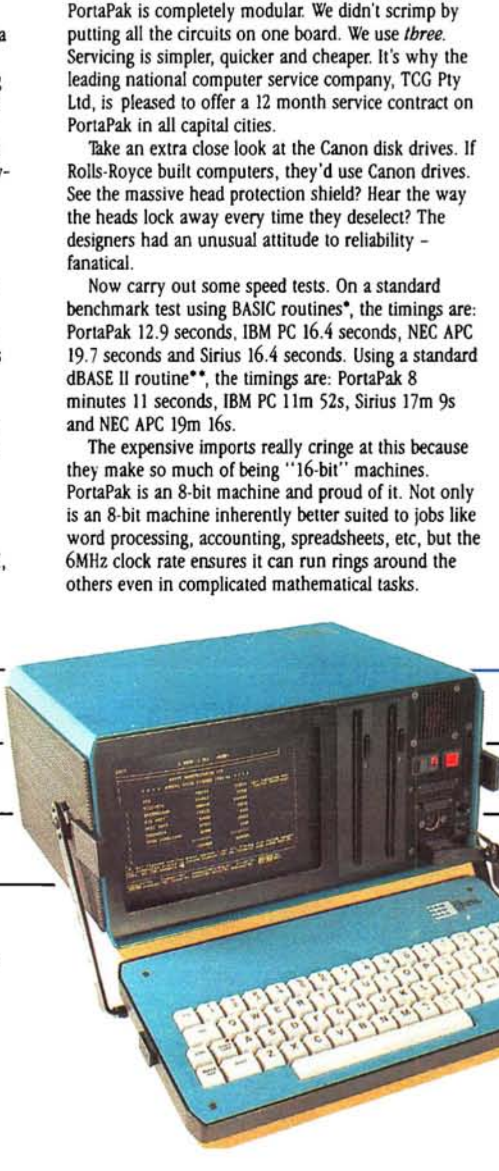

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*See Australian Personal Computer, Feb., 1984.
**See Australian Micro Computerworld, Nov., 1983.

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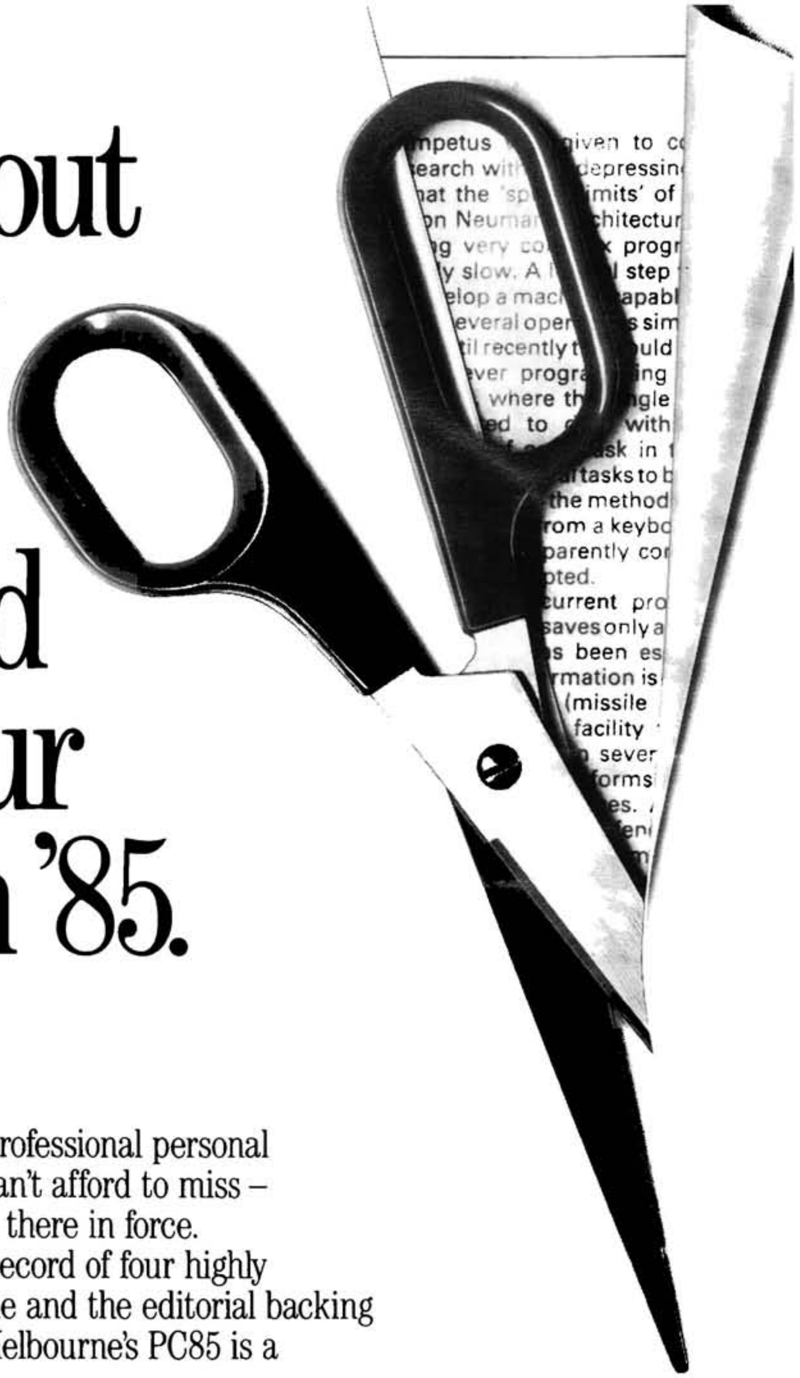

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threat of Chapter XI bankruptcy in America, by rescheduling its debts.

The company's imitation IBM micros have never quite recovered from the blow of a lawsuit from IBM over the close similarity of its internal software to IBM's own, and from a year ago, when it was the darling of American journalists, to today, is a big, big gap.

The plans for the future money-making apparently centre on "vertical markets" and overseas sales.

A bottomless pit

At last, I have seen a computer downloading software from a video disk.

It is the new MSX design from JVC, linked into the VHD disk system, and likely to hit the market later this year —much later.

The idea is that you can mix the picture from your computer with the picture from the disk player, and can decide which file sequences to show under software control.

It looks like a first step, though.

The demonstration games shown to me included the predictable car-racing game, where the picture switches from one lane of a motorway to another as you twitch the joystick. The computer makes it more entertaining by dumping oil barrels into your path.

But the loading of software seems to have been designed by a contemplative monk.

Data for the computer is stored on the videodisk — how, the executives weren't too sure. But it comes off the videodisk at the blinding speed of around 2400 baud.

Ah, well, back to the drawing board. With something like four gigabytes of data possible on the disk, it would take around 5,000 hours (about seven months) to read the whole disk, at that rate — so you can see that this is not a computer peripheral.

The interesting feature of the machine was not its data rate, however, but the games.

Apart from the racing game, most of the demo games involved audience participation, and an expert book-keeper.

Executives told us that Japanese players love to sit round the screen, watching a fruit machine rolling. The audience watches the screen until the fruit is just about to settle, and then they have bets among themselves.

Alternatively, they watch a young man with a mischievous disposition walking through the changing rooms of a sauna/swimming pool, noticing a shapely pair of legs under one of the shower doors. As he opens the door, the action freezes, and the computer makes random jumps — either to an angry young man, or to an embarrassed young lady — after everybody has placed their bets.

My favourite, by far, was the one showing three of those weird aliens from the Star Wars bar, all drinking in a Tokyo hotel. One gets up to visit the toilet, and stops between the two doors.

Which door will it go through — the Gents? Or the Ladies? Place your bets!

Guy Kewney

Coleco calls it quits on computerland

Ten green bottles standing on the wall . . . and what do you know, another green bottle has accidentally fallen.

Coleco is the latest casualty. It looks as if all the king's horses and all the king's men would have their work cut out putting the Adam together again. Coleco has abandoned the home computer market, selling its stock off to an optimistic retail chain and turning its attention to the low-tech business of toys.

In Coleco's case it seems that pride came before a fall. The Adam emerged in a blaze of publicity in mid-1983 and Coleco announced that it would have 500,000 on the streets by Christmas. In the event it shipped fewer than 100,000 and lost the sympathy of some important friends in the process.

The biggest boost the machine received in its short career came just after its first Christmas. Coleco signed a deal with Honeywell through which the big computer manufacturer would offer a national service network for Adam owners. Ironically, even this rebounded on the luckless Coleco by drawing attention to the question of reliability.

In quick succession the large retailer JC Penney cancelled its orders for Adams because the machine failed to meet its quality standards and Consumer Reports magazine refused to rate the Adam because, it said, none of the four early production models it had seen could be coaxed into action. Encouraging comments from Honeywell executives weren't enough to allay public suspicion.

The history of the Adam's fretful progress towards the shops was a story of nagging problems and increasingly weighty doubts. The machine promised much, but by the time it was delivered a large credibility gap had opened. The writing was on the wall before it arrived in Australia, and the Adam never made a significant impact.

There are several strange features in this tale of failure. The Adam wasn't a straightforward home computer — with a built-in daisywheel printer and a pioneering form of high-speed drive, it offered very much more than the average box. But it wasn't a straightforward business computer either — there were question marks against the reliability and durability of the hardware and against the quality of some of the software. Nor, in its initial form, did it have CP/M.

On the face of it, the Adam fell between two stools. Perhaps it was before its time — as a home micro with the potential for serious applications it was a clear forerunner of such machines as the Plus/4, and other systems that will emerge during the year as the manufacturers try to persuade us that microcomputers have to develop beyond games to survive.

So will Commodore etc read the news of the Adam's expulsion from the garden with the feeling that somebody's walking over their graves? It isn't likely. They will console themselves with the thought that Coleco wasn't equipped to enter the home micro market in the first place and that it made mistakes that old hands wouldn't make. They may even gloat at the fact that another loud-mouthed competitor has got his comeuppance.

But Coleco's last words on the Adam are relevant to micro producers all over the globe. 'Rapidly changing consumer preferences, frequent technological developments, overproduction and significant and continuing price-cutting have created an unusually volatile business market which is likely to continue for the near future', the company says. This mouthful means that times are hard for micro makers, and they're not going to get any easier for a while. Coleco, famous for the highly profitable Cabbage Patch Dolls, is turning to toys.

Toys are exactly what most of the present crop of micro manufacturers, the remaining green bottles on the wall, are trying to get away from. The image of the home micro as a toy is one that doesn't satisfy them. But the failure of the Coleco

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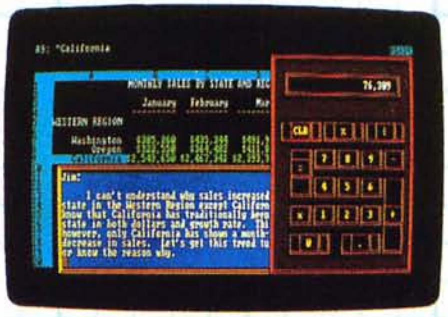
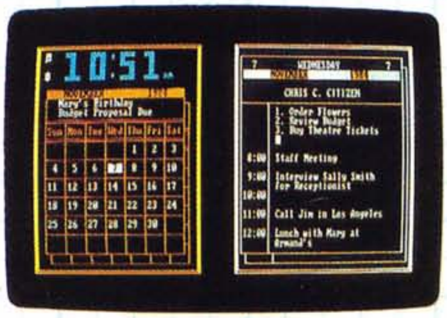


Calculator, Memo Window Over 1-2-3



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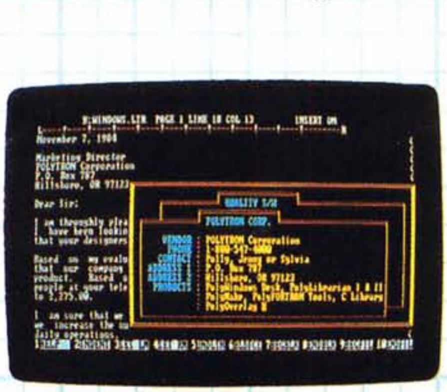

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Adam shouldn't satisfy any of them, and it indicates that 1985 could be another difficult year.

David Guest

You've waited this long

Immediately after finishing this issue of Newsprint, I was planning to head off to Apple's head office, to be told about their new local area network.

Apple is making quite a fuss about this deal — air tickets to California will cost them a bit — and the reason is simple: there is immense scepticism about it in the networking business.

Two areas worry the experts. First, they say, the network is far too slow.

Harry Saal, network pioneer at Nestar, summed it up: "It's the same speed as a thing we had working four years ago on Apple II systems, and it just isn't satisfactory. We'll leave this network to our rivals, 3Com, and make do with the pickings from the IBM business."

The speed is around 300 kilobits per second, where even the slower rivals start at four to ten times that data rate — and some run a great deal faster still.

Speed, however, isn't what worries my pundit friend David Ferris. He's taken the trouble to issue a condemnation of the apparent cost of the system — which Apple says will be $75 per micro.

"We have found that when you add up all the hidden expenses of building a network, the costs of the wires are trivial," Ferris told me. "We've installed more networks in the San Francisco area than anybody else, I'd say in the world, and really, the costs can be as high as fifty times greater than the cost of the micros, and the wires, and the software all together."

However, it isn't all bad news: Ferrin as a company has suffered long enough from the software problem — no software works on most networks — to give high praise to Apple's approach to this.

Tactlessly issuing his release a week ahead of Apple's, Ferris commented: "We give high marks in most areas, especially the announcements about collaboration with software vendors. It will take a long time before most people are able to use Apple Net, but by 1986, we think it will be a serious standard."

I was particularly amused by the number of news media who took the meat of Ferrin's announcement, and reported the Apple network launch without Ferris's comments, as if they'd dug it all out of the grapevine, themselves . . .

Guy Kewney

We're still waiting

A favourite activity of the general press over the last few months has been the reporting on the collapse of the home computer market. It is, they report, over. But the home computer boom is far from being over. Indeed, it hasn't yet started.

The evidence of collapse of the industry, so it goes, is simple — manufacturers who had a wonderful time at Christmas 83/84, had a pretty poor time this Christmas. And the software business had a rotten year, especially on the games side.

The fact of the matter, however, is that nobody, yet, sells a home micro.

What has flooded the market, to the point where potential buyers mostly already have them, is a programmer's exercise bike, usable for sophisticated games. For home use, they are a joke.

How can you manage your history notes on a system with only 100k bytes of data? And, if you log onto a remote database with history information, you can't compare it with your own notes to see if they relate, because the comms program is separate from the text program.

How can you organise your appointments, a trivial, ten second function with a pocket diary, when it takes five minutes to load the diary program from cassette? And when you can't find the data files?

Who is going to use his $500 micro to turn light switches on and off, when that means he can't play Flight Simulator or Chess or Manic Miner?

When computer memory costs $300 for a half megabyte, why are people launching systems with 48k bytes? Why, when there are chips that can control 16 megabytes, are people offering systems that get lost beyond 64k bytes? When autodial modems could be built in for $80 extra, why are the computers not even fitted with sockets into which a modem can be plugged? When processors can run four levels of program protection, why are they not given proper multitasking operating systems? When display tubes can accept data at 10MHz, why are they sending data down a serial wire (which doesn't actually exist except in the mind of the designer) at 9600 baud?

The answer isn't simple. It has to do mainly with our general failure to understand that computers are fundamentally the most useful tools, after the invention of writing, known to civilisation. And also, with our business expectation of a "stable market" in an area where the technology is constantly causing earthquakes.

By the end of the year, the Macintosh will cost $2,000, its Atari rival previewed in the next issue will be available, and there will be one or two interesting machines like the Mind Set and Amiga; and others we haven't heard of yet because they are still secret.

If those machines show no sign of creating new markets, then I'll consider, seriously, the possibility that the home computer boom is over.

As of today, however, I'm still waiting for it to start.

Guy Kewney

And all that . . .

People will tell you that Jazz is the product which Lotus hopes will be as popular on Macintosh as 1-2-3 was (is) on the IBM PC. They are right.

They will also tell you that it is a version of Symphony, their follow-up IBM product, but for the Macintosh. There, they will be wrong.

The new product is superficially like Symphony, in that it includes a proper database (1-2-3 had a rudimentary file searcher) and a full-featured word processor (not just a pad scratcher) and also includes graphics and communications.

But where Symphony is a single database, with a series of different "interfaces" to interpret the data in graphic, or spreadsheet, or text, or database mode, Jazz is actually five programs, integrated with automatic (but cancellable) matching.

In other words, a spreadsheet in both Symphony and Jazz, can be arranged so that data displayed in graphic mode will automatically change if you change the spreadsheet.

But in Symphony, the change arises as soon as you ask for the display change in the graphics. In Jazz, the graphics program has its own file, and it gets changed only when the changes are passed over from the spreadsheet. And it is possible to retain the old data, give it a new name, and file it.

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The product will make a lot of difference to the Mac.

With Symphony, the change from 1-2-3 to the new product was not clear-cut enough for many commentators. All they saw was the complexity, and wondered aloud whether anybody would buy it. To the users, however, the additional database capabilities, plus the comms function, was enough to justify the switch.

With Mac, however, there isn't a 1-2-3 product to compare it with, and users of the computer will compare its five functions with separate spreadsheet, word processor, and so on.

To Mac users, no more need be said.

Those of us who know (and love) the machine are still driven mad by the thoughtful, painstaking, nit-picking and endless way it refuses to be hurried while sorting out its disk drives. To switch from one application to another can take as little as half a minute, or as much as a minute and a half, if there are complex files to open and close.

The prospect of being able to switch from editing a letter, into sending an electronic mail version of that letter, into storing the reply in the database, into getting on with the spreadsheet work for which you stopped to write the letter in the first place — well, it's like magic.

Or at least, it will be, if Jazz lives up to its promise.

One question which is being asked a lot is simply: will it sell? And more specifically, will it sell better than Symphony?

The Symphony problem is largely in the mind. There are those who think that Symphony requires a degree in computer science to understand. And there are those who mutter, darkly, that it has "flopped".

It is always possible that Lotus executives tell me fibs from time to time, but I haven't caught them at it yet, and they claim that, in Australia, Symphony sales are running at around half the rate of 1-2-3 sales.

That, however, is not as bad (from Symphony's point of view) as it may seem at first. This is because of the number of IBM PC lookalike sales and the fact that Symphony is not yet available for most lookalikes. Lotus 1-2-3, however, is. So a large proportion of 1-2-3 sales are for the lookalikes, and very very few of the Symphony sales will run on them.

As to whether Jazz will sell, I feel very happy sticking my neck out and saying "yes, very well indeed."
Guy Kewney

Algorithmic breakthroughs

Theoretical physicists tell us that if you set off travelling in a straight line you'd eventually, after circumnavigating both the known and unknown universes (and perhaps a few more besides?), end up back where you started through a quirk of nature called the curvature-of-space-time — or something equally incomprehensible to lesser mortals still grappling with the mathematical complexities of converting miles into kilometres and pounds into kilograms.

Fear not, there's no need to go off the planet to experience the feeling that, if things go on long enough, they will end up back where they started. This was brought home to me recently by a couple of articles in the computer press.

The first concerns an algorithm — those things that run around inside computer programs doing lots of good work until killed by some nasty bug. If you think they seem rather mundane, well not this one.

Dreamed up by a boffin at Bell labs, to which company we owe one or two useful devices like the transistor, it's apparently all set to turn the computer industry on its

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ear and is such a hot number that Bell's legal eagles are busy wrestling with the thorny issue of whether or not an algorithm is patentable.

What's so good about this one? Well apparently it can greatly increase a computer's capacity to solve linear programming problems — things with heaps of variables like airlines' crew scheduling programs. Bell's explanation of how it works boggles my mind as much as the idea of curved-space-time. So I won't try to repeat it. Suffice to say it's a wonderful little beast and Bell Labs is pretty thrilled about it. There is, however, just one snag – it can chew around such enormous amounts of information that to make full use of it a program might need droves of keyboard operators typing furiously just to keep it fed with data.

When computers first started becoming widely used in the commercial world it became something of a cliche how one computer could do the work of hundreds of clerks. Now, it seems we might need hundreds of clerks to do the work of one computer.

Of course one way to get around the problem of feeding the gargantuan appetite of Bell's new algorithm would be to come up with something to replace that antiquated input device, the qwerty keyboard. People have, of course, been raving about the Dvorak keyboard for ages, but it hasn't really caught on yet. Why not take things a step further? Why have about 50 keys when we've only got ten fingers — the more keys there are the easier it is to miss the right one. The answer's historical: one key for each letter (or two) on a mechanical typewriter.

A little gadget called the microwriter seems to me to be a step in the right direction — it has only six buttons which are pressed in different combinations. My maths may not reach the heady heights of space-time-curvature or linear programming but I can work out that six buttons will give you sixty four combinations and only your thumb has to change buttons.

However, such gadgetry pales into insignificance against voice recognition; just talk your input at the computer. IBM's got an experimental system to do this and apparently a voice recognition phone was recently demonstrated in the US which lets you dial up your home and issue orders to turn on the microwave and similar trivial tasks.

Why stop there? We've already got voice synthesis; Telecom has just brought out its ComputerPhone. Put these together, add voice recognition and let your imagination take off . . . You could personalise your answering service by having the ComputerPhone identify the caller and play back an appropriate message.

The caller could talk in his number and when you want to call him back the ComputerPhone could do it automatically.

It would be useful in very noisy environments, or for the deaf, incoming speech could be displayed on the screen.

The possibilities must be endless.

The second example concerns the ubiquitous spreadsheet which helped to start the microcomputer revolution. Electronic spreadsheets didn't originate with the PC, they just became easier to use and much more accessible than spreadsheet programs on big systems. So what's happened now? As you may have guessed, someone's made a mainframe spreadsheet that looks to the user just like the ones that run on his PC.

Chris Kirkby

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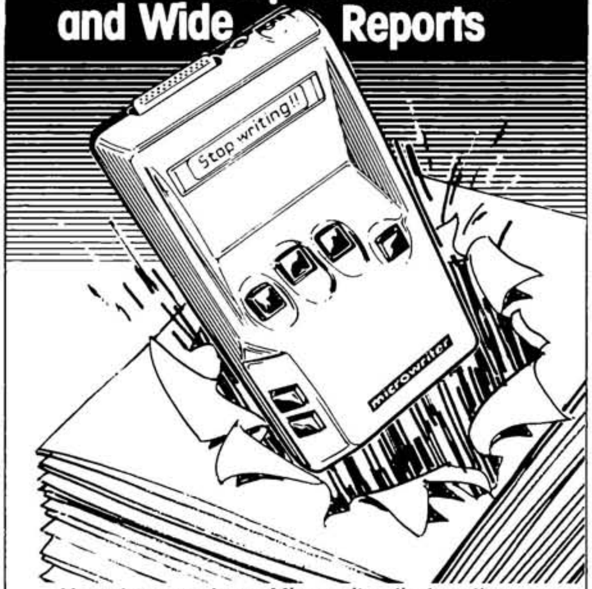

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North Star bounces back

In March last year, when IBM announced its XT, North Star's sales growth stopped abruptly. "In a nightmarish period of 30 days, our sales dropped 30%", recalls Charles Grant, a computer scientist and co-founder of North Star. IBM's XT competed head-on with North Star's main product in the small business market.

Within ten months, after a furious product development effort, North Star unveiled a new system which it says will beat IBM at its own game. The new product, Dimension, is said to run software designed for the IBM PC, but unlike the PC, it can accommodate up to 12 users. Additionally North Star says most IBM PC hardware add-ins will also run, but with minor software modification.

Standard 3-Com networking protocols are employed by the Dimension's operating system to provide file

If you've just spent a packet on a letter-quality printer, get your hanky out.

You're about to discover an extraordinary new range of dot-matrix, near letter-quality printers that cost only a fraction of what you would have expected to have to pay in the past.

It's the EPSON® "Plus" series. The EPSON FX-100+ and the FX-80+.

Their print quality is superb. They will print near letter-quality pages, quick drafts, even complex graphics, with a definition that's seldom equalled in any price range. And you can vary between different typestyles.

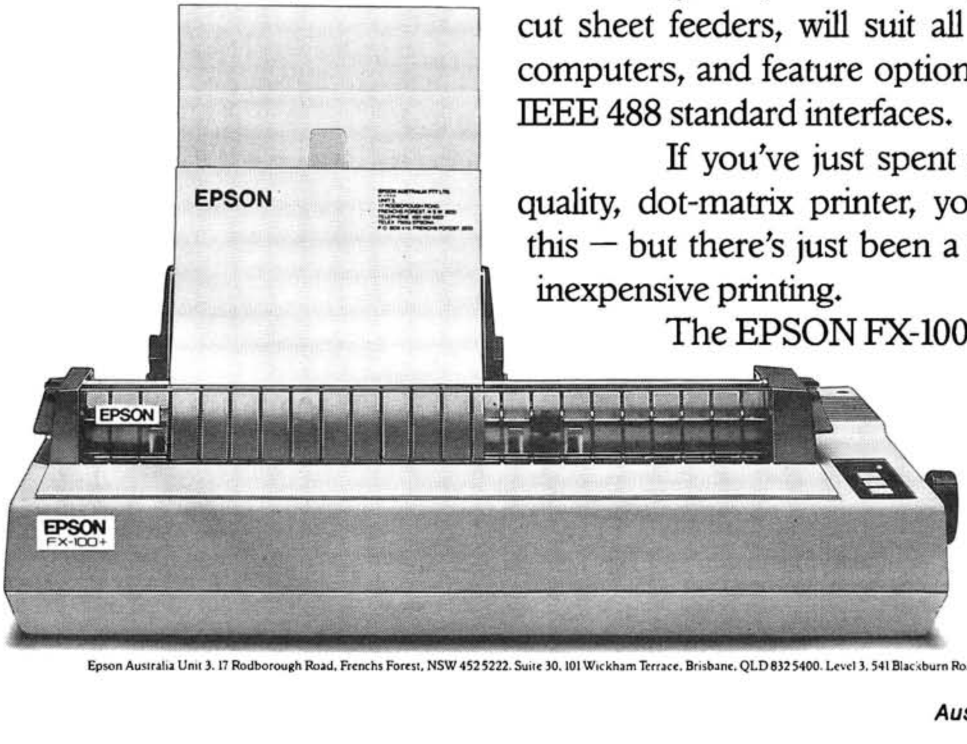
Their speed has been enhanced, not by increasing the number of characters per second (in this case, up to 160 cps), but by speeding the rate of paper throughput.

The result is an effective overall speed which rivals that of printers costing much more.

As well, the EPSON "Plus" range of printers have provision for optional cut sheet feeders, will suit all popular brands of computers, and feature optional serial and intelligent IEEE 488 standard interfaces.

If you've just spent a packet on a letter-quality, dot-matrix printer, you won't want to read this — but there's just been a new standard set in inexpensive printing.

The EPSON FX-100+ and the FX-80+.



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Wordstar 3.3; D Base II or III; Attache Accounting Software, and many more.

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The Hitachi Corporation's sales for last year were in excess of 19 Billion U.S. Dollars. In short, they have the resources, the technology, and the financial stability to be around for a very long time.

Specifications

The Hitachi 16002 comes with 128K bytes of user RAM (expandable to 384K); dual 5" DS/DD Disk Drives; new IBM graphics card; 16 bit CPU; High resolution colour monitor; MS Dos and Basic.

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and record locking facilities. Each user has an 8088 cpu and a minimum of 128k of RAM.

A typical system of 12 users with a 15Mb hard disk costs around $3,500 per user excluding sales tax. Call (03) 792 4152 for more details.

Mainframe network gateway

An IBM 3270 SNA (ie mainframe) gateway is now available for Fox Research's 10-Net local area network. So now Software Corporation of Australia (10-Net's distributor in this country) can connect up a firm's IBM PCs and then connect this network to the firm's mainframe, enabling each PC on the network to 'talk' to the mainframe.

The gateway feature is to be introduced in Australia from $2,950. Details are available on (03) 347 7011.

Troppo

If you've ever wondered why Burroughs doesn't get more of a mention on these pages, take the first paragraph of a press release from the firm as a possible typical reason:

"Two Burroughs B25 computer systems are being installed on Norfolk Island, a location so idyllic and restful it will turn other computers' display screens greener with envy." The screens are not all that are turning 'greener'.

The release later states: "The isolation of being on an island 1600 kilometres from Australia's mainland, does not concern the B25s in the slightest. In the event of equipment failure it is capable of running programs to identify failing components. The modular construction of the B25 means that the 'ailing' part can be easily removed and flown to one of the Burroughs engineering repair centres in Australia".

We're not going to tell you what Burroughs did for the Tea Tree Gully Public Library — the highlight of a subsequent release.

Software training

Prentice-Hall is using demonstration software as the basis of a tutorial product series for the IBM PC. Titled the 'Apprentice Series' each package includes a teacher's guide, a licence to copy the demonstration software (a fully blown version of the software product limited only by the capacity for output) and a workbook. Each student requires a workbook and a copy of the software. Self study versions are also available.

Sixteen titles are promised "very soon" and include packages such as dBase II, Supercalc, Multimate, Visiword and Open Access.

Call (02) 939 1333 for more details.

VZ-200 into puberty

Steve Olney has produced a machine code utility which "re-enables all 23 hidden commands resident in the VZ Basic ROM". Apparently this means VZ-200 will then have most of the Level II TRS-80 commands and a couple more. It'll set you back a moderate $15. Write to Steve Olney, 200 Terrace Road, North Richmond, 2754.

Jap drive for the '64

A Japanese drive, said to be compatible with the 1541 Commodore unit, has been released by Porchester in Australia. It's called the Century Skai-64, plugs into the same connector as the 1541, and according to Porchester, loads all 'standard' software tested so far including Flight Simulator and Ghost Busters.

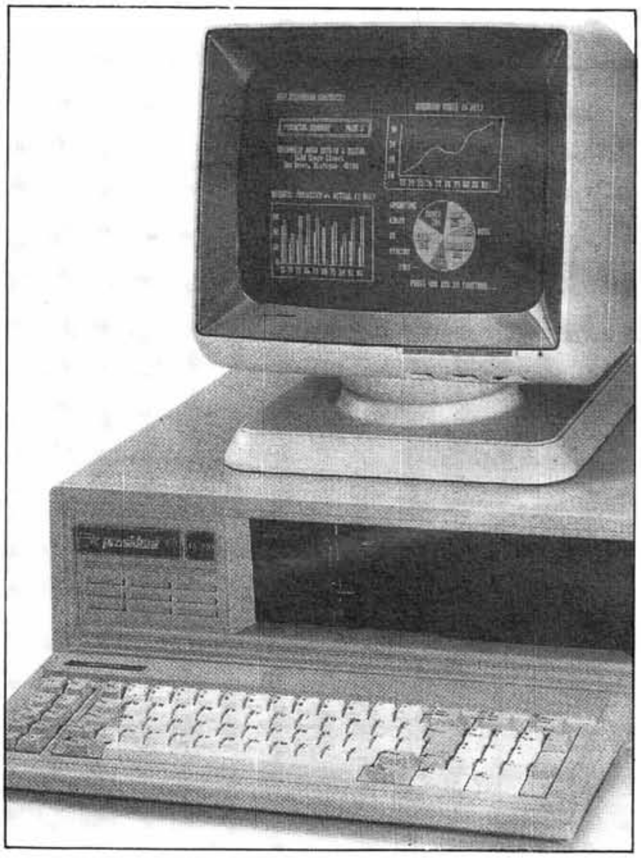
A six month warranty comes with the Skai-64 which sells for $299. 'Phone (03) 417 6126 for details of availability.

Donations required

Youth Counselling Service, a non-profit government agency, is forming a computer education program for young people who would otherwise be unable to afford computers and instruction. The program offers free instruction (for example Plato typing tutor, remedial education, programming etc) and an opportunity to assist youth interested in computers.

The Computer Club is seeking donations of computers, peripherals and software for hands-on learning and experimentation and will pay the shipping costs.

So dig out the old TRS-80 from the garage and send it to the Youth Counselling Service, 80 Main Street. Blacktown 2148. Telephone (02) 671 1332 for more details.



Most of the features of President Computer's new IBM PC workalike are not shown in this photograph. It comes with 512k of RAM (which is expandable to 1024k), an 'intelligent' video display card (combining colour and mono modes under software control) and up to two 320k floppy and two 10Mb hard disk drives all inbuilt into the main cabinet. A portable version of the above with the exception of a limit of one hard disk is also available.

Bundled software in the form of GW Basic, Perfect Writer, Filer, Speller and Calc and Eazytype, is supplied with all machines. Call (02) 476 2700 or (03) 529 1788 for more details.

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7. Is there a choice of desktop or portable model like the AWA Corona?

8. Can you buy the complete system for around $5000? (The AWA Corona starts from around $4500).

9. Does 'complete' mean the screen is included in the price, as with the AWA Corona?

10. Does it include the MS-DOS[1] GW BASIC[2] PC Tutor[3] and MultiMate[4] professional word processing system like the AWA Corona?

11. Is it fully backed and serviced by the company that supplies it to you, like the AWA Corona?

12. How quickly could you have one? Call AWA now.

Saatchi AW66

For more information write to: Corona PC Co-ordinator, (AP).
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Sharp MZ-5600

Sharp has taken a brave step in launching a 16-bit business machine which is not IBM compatible. Whether it be a question of Japanese pride or unfamiliarity with the market, Bob Piper still feels that the company's reliable track record will guarantee the machine a decent future.

The fiendishly cunning Japanese are trying to smuggle in business computers disguised as video recorders. Suspicions were aroused by the low profile angular lines and matt silver finish of the Sanyo 500 series. Their latest attempt, however, the Sharp MZ-5600, confirms Australia's worst fears. Not only does it share the same 'living room' looks as the Sanyo, but it also sports an audio output socket and slider volume control on its front panel.

Beneath the facade, however, lurks a serious business machine boasting an Intel 8086-2 CPU running at 8MHz, 256k RAM, a 640k floppy and a 10Mbyte winchester disk. This is most definitely not the kind of specification associated with 'domestic quality' computers. The machine includes some thoughtful features, although the thinking behind the choice of outdated CP/M-86 and a non-IBM PC compatible implementation of MS-DOS, is more puzzling.

Hardware

The first thing that attracts attention is the MZ-5600's enormous size. The review machine was supplied with a 15in colour monitor standing on a pedestal base, which no doubt did a lot to contribute to the overall impression of enormity. The processor footprint measures 17ins wide x 16in deep and is larger than average, but with the monitor on top, the height of the combo is 21 inches. This height coupled with the large 15in screen makes it possible, some may say advisable, to sit a fair distance from the screen.

Finished in greyish white, the Sharp is an impressive looking machine but, be warned, it does consume an awful lot of desk-top. The front of the processor unit houses along the top row, an audio output speaker, a hard disk and floppy disk both fitted with green 'busy' lights. The bottom row from left to right comprises a power on indicator, audio output socket for connecting the sound generator straight into the hi-fi, reset button, audio volume control, and front keyboard connector. The front reset button is a handy idea but would be safer if it were further recessed or subject to a time delay before initiating its drastic action. The unusual keyboard connector looks like a mini DIN plug, but it is more difficult to assess the correct orientation and not impossible to distort the pins in the attempt.

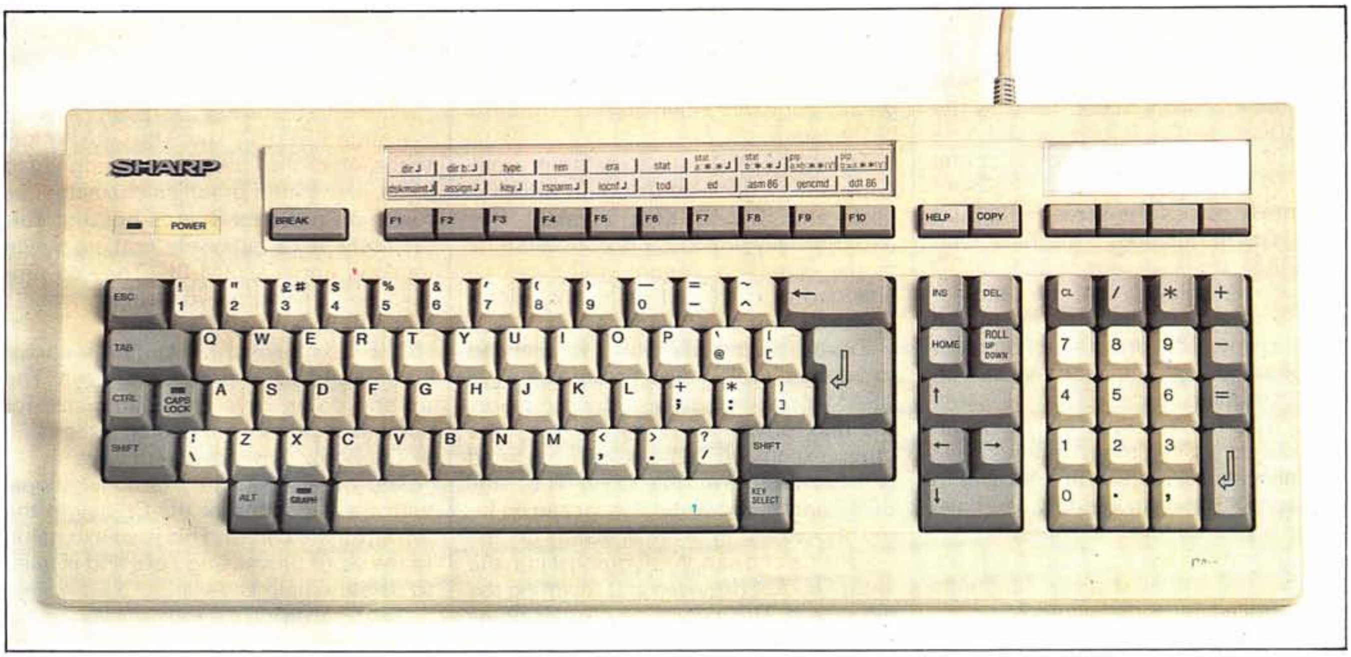
The upper level of the rear panel houses four blanking plates where expansion boards can be fitted into the separate chassis without the need to remove the main casing. To the right of this is the mains input socket with a grounding terminal alongside it, another hangover from the hi-fi trade, which is intended to cut down interference on adjacent electrical appliances.

Along the lower level from left to right are a second keyboard socket, a connector for an additional external floppy disk drive, a centronics compatible parallel port, two RS232C ports and conventional DIN connectors for both monochrome and colour (RGB) monitors.

The on/off rocker switch is conveniently located on the left-hand side of the machine, and well-recessed.

Turning the machine upside down reveals a removable panel and a hole on the casing permitting access to a single dip switch. The settings on this switch may have to be changed when hardware options are changed or added and the panel saves having to remove the main casing. The MZ-5600 does not carry out auto-diagnostics each time it is switched on. If the user suspects all is not well he can change positions on the dip switch to initiate a lengthy diagnostic procedure. This is a welcome idea as the time some machines take to go through their diagnostics, which 999 times out of 1000 are OK, is becoming increasingly unacceptable.

The dip switch can also be used to detune the MZ-5600's 8086 processor



'The keyboard is a real gem — hard to fault either in terms of layout, build quality, or key response'

from 8MHz to 5MHz as some applications software cannot handle the extra speed.

Removing the main cover involves taking out no less than eight screws. Inside the machine seems much more crowded than we have become accustomed to. The power supply is shielded on three sides and occupies three inches of the entire left-hand side except for an extremely lo-fi audio speaker. The fan, which draws air out of the interior, passing it through the power supply before venting it through the side, is inexcusably noisy. Maybe the cramped interior has dictated that a really powerful unit has to be used, but other machines seem to use quieter units without overheating.

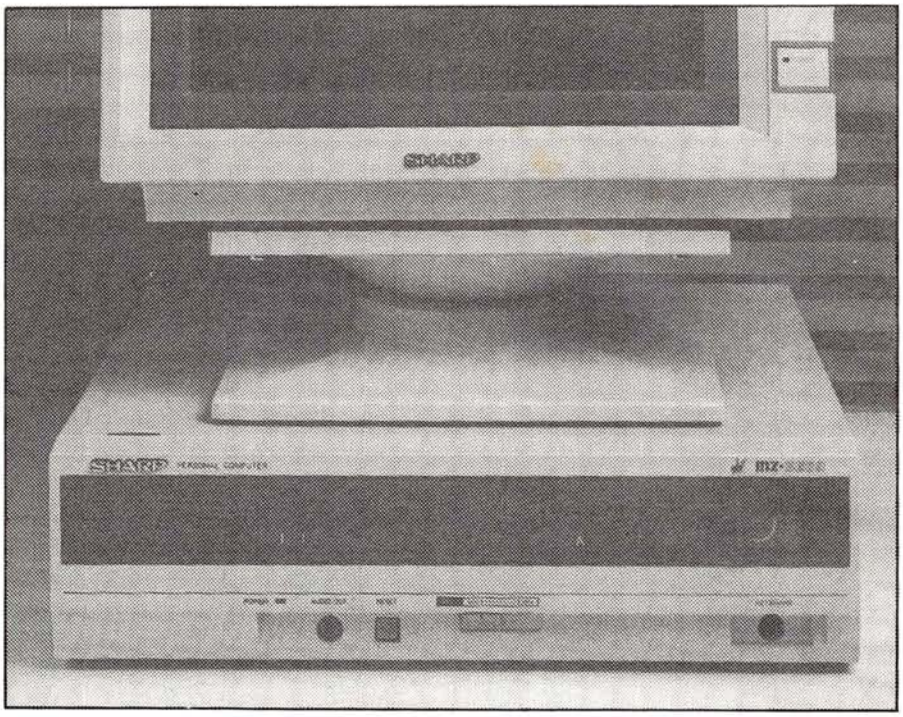
The motherboard occupies all the remaining space at the lowest level. Above it are screwed the disk drives to the front and the expansion chassis to the rear.

The DSDD floppy unit is manufactured by TEAC and has a capacity of 640k, while the hard disk unit comes from yet another competitor, Hitachi, and .has a capacity of 10Mbytes. Both units are noisy, especially the TEAC unit, which makes such loud banging noises that you expect the disk to come out dissected into several parts.

The motherboard contains the Intel 8086 coupled to 256k RAM and 92k dedicated video RAM. This can be expanded to 192k by the addition of extra chips, but it is necessary to remove the drives to do this.

The advantages of doing this will be greater resolution and a larger palette of colours. For instance, with 92k VRAM and 640 x 400 resolution with a monochrome monitor, only three shades of green are possible. With 192k VRAM this figure increases to six. Basically the MZ-5600's display is bit-mapped, one dot on the screen corresponding to one bit in VRAM. Graphics are displayed horizontally across the screen in 16-bit words. On the standard machine with 92k VRAM, three screens of 600 x 400 resolution displays can be stored. Screens cannot be transmitted to the CRT directly but must be directed through windows. The windows can be any rectangular shape up to the same size as the CRT screen, and up to four can be displayed at any time. Windows have to be allocated a display priority within the range 0-3 and no window can have the same priority level as another.

The MZ-5600 has eight basic colours in its palette, and all window functions are controlled by a dedicated LSI controller. The whole idea seems to work well but at the moment can only be accessed through Sharp Basic. The demo program supplied with the machine, written in Basic, demonstrated the four graphics windows moving around the screen, overlapping, splitting and changing priorities to great effect.


The front of the processor houses audio output, hard and floppy disks

While on the subject of special effects the sound generator is worthy of mention, although quite how it is intended to be used in a business machine I cannot hazard a guess. There is an 8330 sound chip with three polyphonic channels covering eight octaves from 20Hz to 20KHz. It is, therefore, possible to produce three note chords over the whole range. Degradation through the integral loudspeaker is very noticeable but greatly improves when played through a hi-fi system.

The MZ-5600 has a real-time clock with battery back-up using an RP5C01 chip and 32.768KHz crystal. This automatically provides the date and time to the operating system which can be changed or corrected using the appropriate system commands.

Expanding the MZ-5600 is intended to be child's play. Apart from the extra VRAM described earlier which requires the disk drives to be removed, all the other expansion options can be fitted without removing the case. The Intel 8087 arithmetic co-processor can be fitted by removing a small hatch on the underside and simply plugging it into the vacant socket provided and resetting the dip switch. The expansion chassis plugs into the motherboard and is screwed onto the main chassis. This provides four horizontal expansion slots, although our hard disk review machine had the top two filled by the hard disk controller. Strangely, maximum memory is only 512k as opposed to the more normal 640k found on 8088/8086-based micros but should be enough for most users' needs.

The keyboard is a real gem. Designed to ISO standards it really is hard to fault the unit either in terms of layout, build quality or key response.

To indicate status the keyboard has a second power on LED and further LEDs on the 'CAPS' lock and 'GRAPH' lock keys. The keys are divided into four main groups.

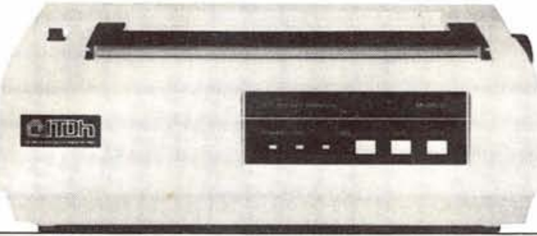
A notable feature of the qwerty keypad is a large RETURN key. The GRAPH key to the left of the space-bar is designed to input predefined graphics characters as found on previous Sharps but, not surprisingly, does precisely nothing when working under CP/M-86. They do produce some pretty weird looking symbols when in Sharp Basic.

The next keypad contains the cursor control and word processing keys. The up and down keys are double size for some reason and situated on either side of the horizontal movement keys.

The numeric keypad is conventional with the exception of the CL key in the top left-hand corner. This is an extension to the word processing keys and is used to delete whole lines.

The final group extends across the top of the other three and comprises 17 function keys. Starting at the extreme left is the conventional BREAK which is

C.Itoh dot matrix printers stack up in every way.



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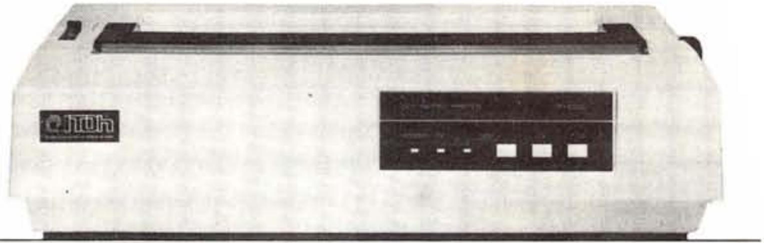

MODEL 1550S
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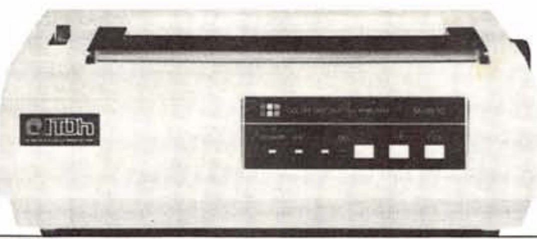

MODEL 8510SC
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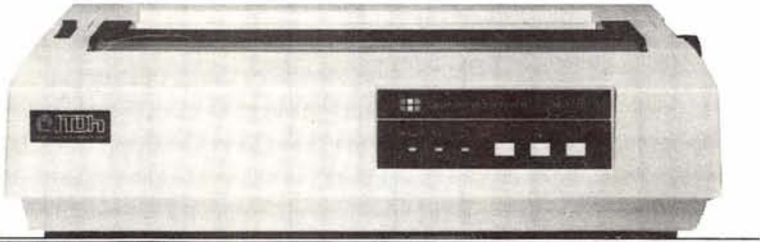

MODEL 1550SC
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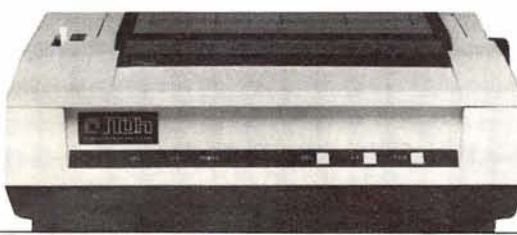
COLOUR?



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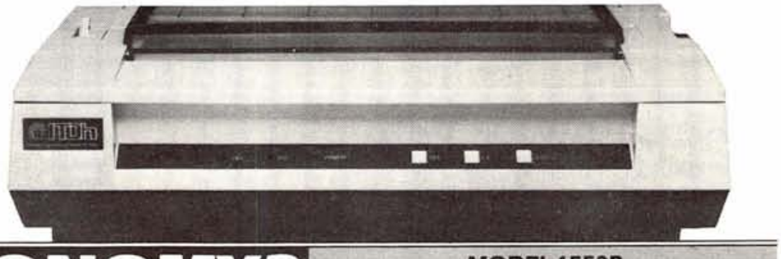

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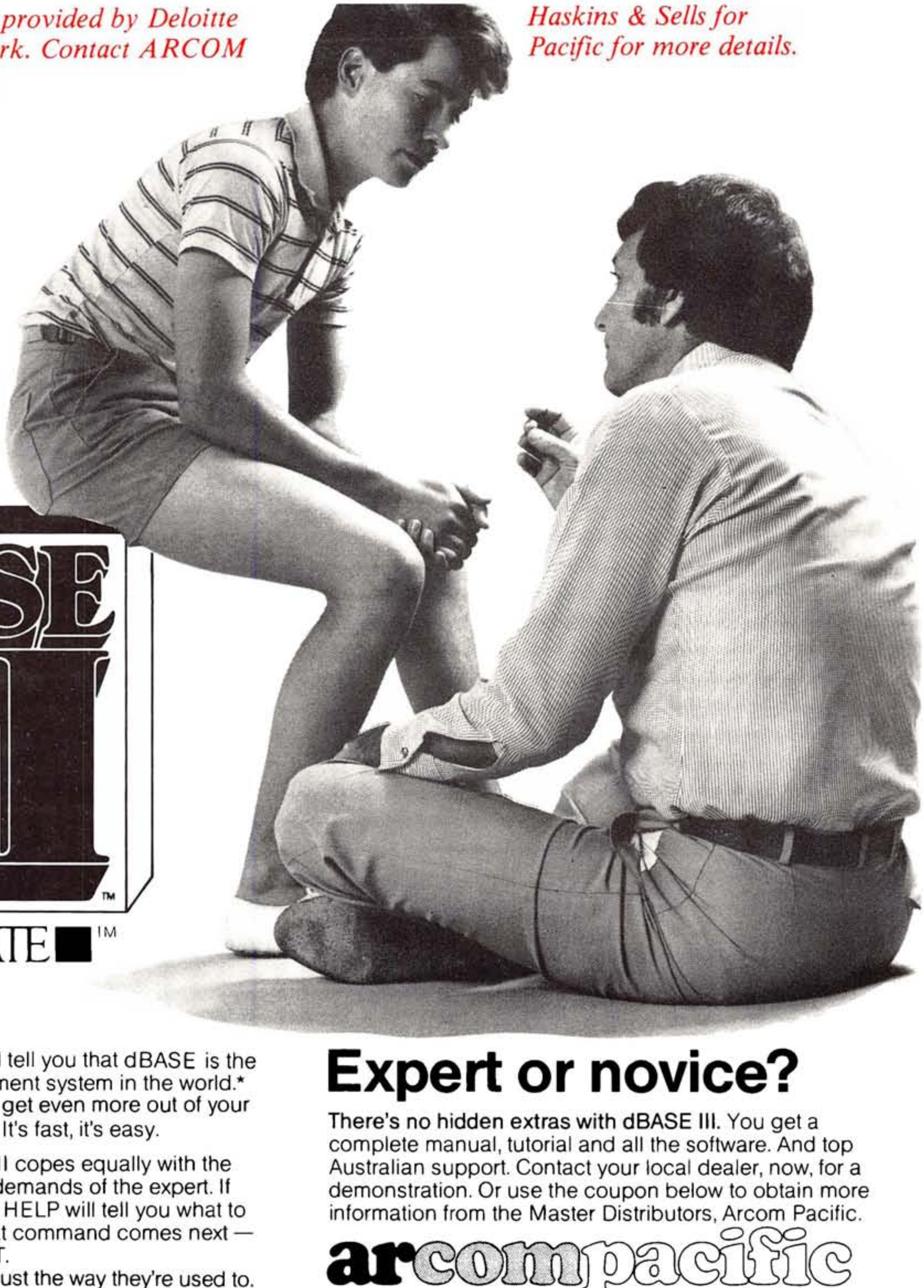

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followed by 10 user-definable function keys. Next there is HELP, which is intended to provide useful information whenever it is pressed, but as it only produces a HELP string followed by a carriage return it is very dependent on the package accepting such an instruction. It works well, however, with CP/M-86's HELP facility.

The COPY key is used to dump the contents of the screen to the printer and is equivalent to the PRINT SCREEN key found on other computers. The remaining four keys are something of a mystery as they do not appear to be user-programmable in the same way as the others. Further investigation reveals they are for use in Sharp Basic programs in debugging and window management. As the machine is probably going to be used more for running applications software than Basic programming it seems a waste to dedicate four keys in this way.

Each group of user-definable function keys has a clear perspex cover above them where suitable cards can be placed describing the keys' action. As supplied for review the keys produced a very comprehensive set of CP/M-86 command strings and certainly saved a lot of time when working at system level. Actual user defining of function keys is covered in more detail under the 'System software' section.

The keyboard is controlled by an 80C49 chip and has a 63-character buffer. This means that although it is theoretically possible to type ahead of the computer by up to 63 characters, in practice it is difficult, as none of them will actually appear on the screen until the processor is freed from its original priority task.

The keyboard has a two-key rollover facility and auto-repeats on most non-function and non-system keys.

It also has a rear edge tilt facility and a mouse port. Key action seemed just about right with the correct blend of tactile feedback and robustness. In short it is the sort of keyboard that grows on you; the more you use it, the more you like it.

The 15in colour monitor is a large unit. It is in fact quite good looking with a very attractive flat screen but its overall size tends to detract from the final impression. The tilt swivel base is fixed onto the base of the monitor with four large screws and, although allowing precise adjustment of the screen angle, it does seem to add an inordinate amount to the overall height of the combined unit.

Brightness, vertical size, vertical hold, horizontal centre and horizontal hold commands are located behind a flimsy side panel. The combined on/off push button and pilot are placed on the front of the unit.

A separate mains supply is required but the RGB connection is a flying lead fixed at the monitor end.

The 80 x 25 character and graphic colour displays were top quality with excellent resolution and stability, especially when the extra large screen size was considered. However, when operating at system level in black and white, the screen produced a weird green ghosting when scrolling.

System software

The Basic interpreter included with the MZ-5600 series is written by Sharp and is not a modified Microsoft version. It is a very comprehensive and powerful language occupying no less than 104k of memory.

'Expanding the MZ-5600 is intended to be child's play. Apart from the extra VRAM which requires the disk drives to be removed, all the other expansion options can be fitted without removing the case.'

The core of Sharp Basic differs a little from others. For instance, to print to the screen one does not use PRINT but DISP. The more complex commands concern graphics and windows manipulation which are very much tied up with the use of the video RAM.

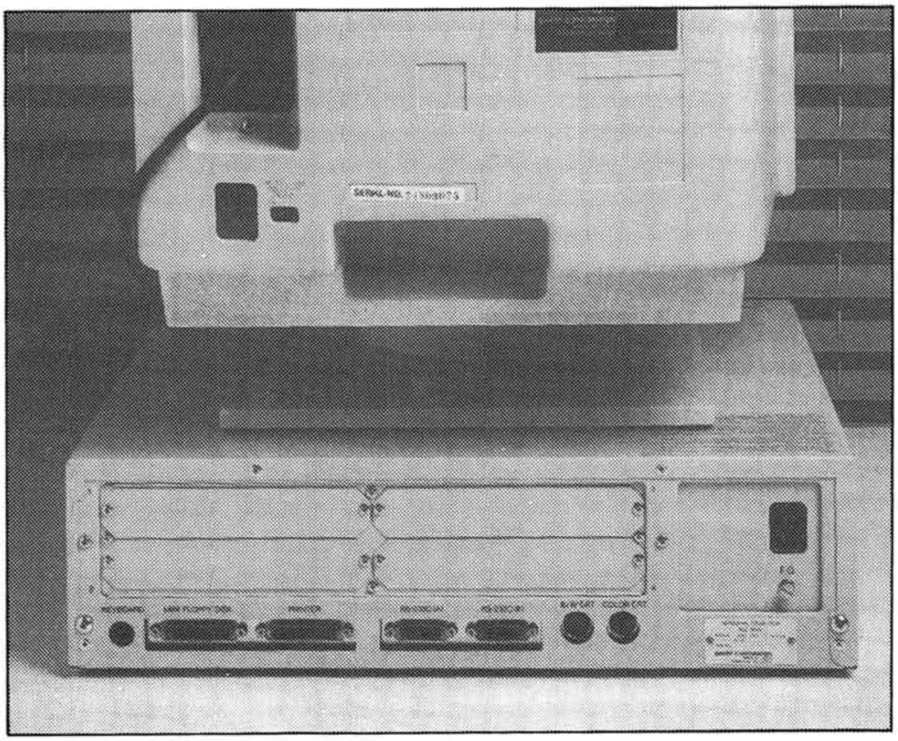
A typical example is as follows: SEL C,G,W will display text and graphics together on the same screen. 'C' represents the screen number in VRAM assigned to text, 'G' is the screen number assigned in VRAM to graphics and 'W' is the screen number used as a background.

There can be little doubt that Sharp Basic has some very powerful graphics commands; but reference to the Benchmarks reveals how slow it is as a general purpose Basic.

Sharp Basic in fact operates under FDOS, Sharp's own operating system, which in turn works under CP/M-86. Consequently, when disk access is frequent, things could slow down even more.

Although Sharp has no intention of bundling it with MS-DOS, Microsoft's GW-Basic will probably be available through one of the software distributors at a moderate price. Microsoft Basic Benchmarks supplied by Sharp show the machine running much faster.

The MZ-5600 series is being launched with both Digital Research CP/M-86 and Microsoft MS-DOS operating systems. At the time of writing the MS-DOS implementation was not



At the rear, four blanking plates will accommodate expansion boards

Technical specifications

Processor:	Intel 8086 running at 8MHz
ROM:	16k
RAM:	256k standard, max 512k
Video RAM:	96k standard, max 192k
Mass storage:	640k DSDD 5.25in floppy disk, 10Mbyte 5.25in hard disk
Keyboard:	ISO standard, 103 keys
Size:	Processor 17in(W) x 16in(D) x 4.8in(H), 15in monitor 16in(W) x 16in(D) x 16in(H)
I/O:	Parallel (centronics) RS232C, two floppy disks, composite video and RGB monitor
DOS:	Extended CP/M-86 Extended MS-DOS Version 2
Bundled Software:	None
Options:	Extra RAM (up to 512k), extra VRAM (up to 192k), mouse, monochrome monitor, 14in colour monitor, 15in colour monitor

quite complete and Sharp could only supply a preliminary system disk for review. But the company's overall philosophy with both systems is to extend them with various utilities which not only help realise the machine's full potential, but make it much easier for users to configure the system to suit their own needs.

The review machine was supplied with CP/M-86 on the hard disk, so on powering up the MZ-5600 first looks for a floppy disk. If there is none present it boots up from the hard disk and, after displaying the status of the memory map and hard disks, produces a system prompt.

As supplied, the hard disk is partitioned into two sectors of 5Mbytes each, and Sharp tells me this cannot be changed by the user.

The function and HELP keys are fully configured to produce a wide variety of system commands. Press the 'HELP' key and the standard CP/M Plus type list of available topics appears on the screen with the addition of Sharp's extra utilities.

Function keys 1 to 10 are programmed to produce some quite complex strings. F10, for instance, initiates "PIP B:=A:*.*(V). and F7 STAT A:*.*. The commands which display status incorporate a carriage return, but those which actually write to disk require the operator to confirm initiation by supplying his own return. The function keys are set up using the 'KEY' utility. This displays a list of the current assignments for each key plus their shift modes. Pressing the required function key displays the current string in an entry line which can be changed by over-typing. All keys on the cursor control keypad can also be reprogrammed using this utility. When finished the changes can be saved with a CTRL C or abandoned with a CTRL Q.

The INSTALL utility is used to set up the parallel printer driver. Unfortunately the only printer driver supplied was for a Sharp printer, so the machine would not drive an Epson RX80 from the parallel port. Sharp informed me that by the time the machines reach the dealers more drivers will be available which should be the case by the time you read this.

The DSKMAINT utility is used, as the abbreviated initials imply, for general disk maintenance purposes. It is probably slower than using CP/M commands directly, but it is easier to follow and less prone to silly mistakes. Floppies can be copied, formatted or verified and it is also possible to copy over just the system tracks onto a formatted floppy. In default mode the Sharp automatically verifies after writing to disk, but this feature can be disabled if speed rather than accuracy is important.

The ASSIGN command enables physical to logical device assignments to be reviewed and altered. It can also be used to change the physical labels given to the disk drives. For instance, on the review machine the two partitions of the hard disk were labelled A & B and the floppy I. This could easily be changed to the hard disk with I & J and the floppy, A. Basically the ASSIGN utility is a more specific implementation of the STAT CP/M utility, but much easier to use.

RSPARM enables the parameters of both serial ports to be configured. The parameter menu displayed is very comprehensive including, among others, word length, parity, stop bit, X on/X off and of course baud rate which has a maximum setting of 9600. All the above utilities will, of course, modify the operating parameters during the current session, but on switching off they will all be lost. However, by using the BIOS item on the IOCNF utility menu they can all be saved onto the boot tracks of the operating system.

IOCNF is a really powerful tool boasting some other useful features as well. It can be used to define a command string to be executed on start up in much the same way as the CP/M SUBMIT command. The difference with the Sharp utility is that there is no need to get involved with the awkward CP/M utility ED, just type in the required string and the machine sets up the necessary file.

The MZ-5600 has a somewhat crude RAM disk facility which can be set up through IOCNF. It is possible to allocate blocks of memory, 32k at a time, to the RAM disk which is assigned the physical label 'M'. The machine then uses this in place of disk storage. The snag is that there is no auto-save facility, so when the memory area gets full the user must remember to perform a PIP M: = A:*.* command before switching off.

BKUP and BRST are two utilities used to back up the hard disk. The former copies data from the hard disk to floppies in compressed format, while the latter copies back from the floppies to the hard disk, expanding the data in the process. DSKCNV is a disk format conversion utility which enables the MZ-5600 to read other disk formats. Those covered include the Sharp MX-3500/5500 and IBM PC single or double-sided but all in CP/M-80 or -86 format.

The MS-DOS preliminary operating system supplied did not have DSKCNV utilities, but would accept and read the directories straight from IBM PC disks.

By the time the machine reaches the dealers the MS-DOS system disk should have the same utilities as the CP/M-86 version. Sharp has obviously gone to a lot of trouble to make the operating systems easier to use and to adapt to suit specific needs. There are many other machines around that would benefit from the Sharp treatment.

Application software

Sharp does not intend to market the MZ-5600 series with any applications.

Although the range is not IBM PC compatible Sharp seems fully aware of the potentially disastrous results that can occur when a machine is launched without sufficient software. It has already prepared a preliminary catalogue of CP/M-86 software. Major applications packages include the full Micropro range, dBase II, SuperCalc 2, and SuperWriter. Vertical markets and programming languages also appear well catered for, but it is hard not to question Sharp's adoption of CP/M-86 as the operating system for all this software.

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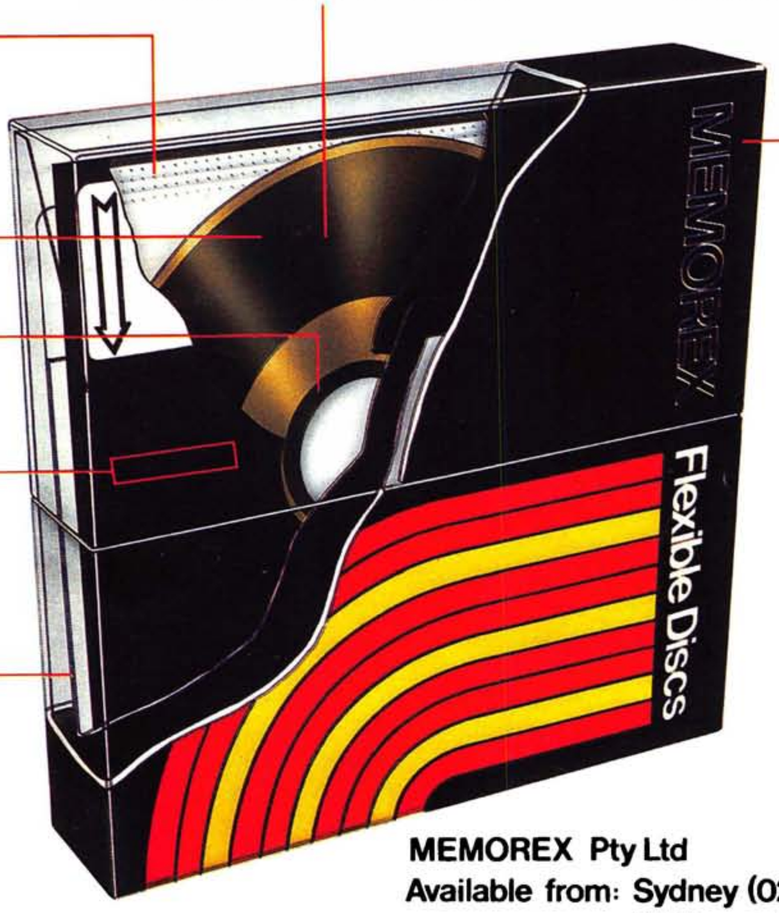

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It is unlikely that any exciting new packages are being developed for use under this system, as MS-DOS has swept the board in the last few months as far as single-user operating systems are concerned. With the introduction of the multi-tasking Concurrent CP/M, which boasts in PC Mode an MS-DOS emulator allowing MS-DOS programs to run, it is even less likely that the software houses will launch packages designed to operate under straight CP/M-86.

The picture with MS-DOS is more optimistic. At the time of writing, the catalogue of MS-DOS software had not been released but it should make interesting reading. Sharp had just agreed with SPI to port Open Access onto the MZ-5600 series and other major IBM style applications packages should follow. Although not an IBM PC compatible in the accepted sense of the word, the hardware specification can be detuned sufficiently to emulate the IBM PC very closely. Consequently, software modifications are likely to be of a minor nature. The Tandy 2000 finds itself in a similar position regarding PC compatibility and it has already demonstrated that software houses will produce special versions if the demand is sufficient. Make no mistake, however, off-the-shelf IBM software does not stand a hope in hell of running in standard form.

For review purposes Sharp supplied WordStar, SuperCalc 2 and dBase II, all of which seemed to work well, but not noticeably quicker than they would on a conventional speed 8088-based machine. Function keys were not configured, but this presents no problems on the Sharp, as customising their functions to suit individual tastes using the KEY utility, is very simple.

Packages written for the earlier MZ-3500 series can also be patched to run on the new model. Data files prepared on the 3500 series can be converted to the new format by selecting one of the options in the disk conversion menu. This facility provides a well-thought out upgrade path for loyal Sharp users.

Documentation

As supplied, the documentation was all contained in one massive, boxed A5 binder comprising six separate softbound manuals. Unfortunately the binder is so tightly packed that the individual manuals have to be removed for reading. Furthermore, as they are conventional paper backs and not ring-bound they refuse to stay open at the required page.

> *'The Basic interpreter included with the MZ-5600 series is written by Sharp and is not a modified Microsoft version. It is a very comprehensive and powerful language occupying no less than 104k of memory.'*

CP/M-86 was covered by reprints of the three heavyweight Digital Research manuals entitled *User's Guide*, *System's Guide* and *Programmer's Guide*. Although they have long set the standard for user hostility they are comprehensive, but users will need considerable determination to find the particular piece of information they're looking for.

Fortunately, Sharp has covered its extensions to CP/M-86 with an excellent supplement, which uses screen displays and examples to great effect. To some extent, however, the set-up utilities covered in the manual are so well-prompted from the screen that the write-ups become almost superfluous.

The Owner's Guide looks rather inadequate when compared with the complexity of the machine, but in practice works rather well. The first section covers setting the machine up and explains the basics of operation. Subsequent sections each increase in complexity, until eventually it is more like a very abridged technical reference document packed with useful information for those who wish to explore beyond the straightforward use of applications software.

The Basic reference manual is excellent. The first quarter is dedicated to the explanation of Sharp Basic's more advanced commands. The remainder details commands individually, each one explained fully and illustrated by examples. Two reference booklets are also included in the standard package, one covering CP/M-86 and the other covering Sharp Basic. Although the former is basically a reprint of the equivalent Digital Research document it does, however, cover details on the Sharp extensions.

At the time of writing documentation covering MS-DOS was not available, but it will most likely adopt a similar format to that covering CP/M-86, that is the basic Microsoft manual plus a Sharp supplement covering the extended facilities.

Conclusion

As with Sharp business computers in the past, the MZ-5600 series has some outstanding aspects, but the Japanese designers seem somehow out of touch

In perspective

With the business computer market in its present state, two groups of machines are notching up most of the sales. On the one hand we have the IBM PC and its clones, while on the other we have machines offering innovative features usually associated with user-friendliness, like Apple's Macintosh and Hewlett Packard's Touch-Screen.

Unfortunately by opting out of both these groups Sharp automatically places the MZ-5600 among the also-rans. The new Tandy 2000 finds itself in a similar position offering a better hardware specification than the IBM but sacrificing PC compatibility in the process.

One machine that manages to combine the best of both worlds is the Olivetti M24 which uses a full 16-bit chip, offers improved mass storage and graphics capabilities but will still run practically any IBM software you care to feed it. The M24 is not expensive either.

However, it's not too late to save the day. If Sharp is prepared to swallow its pride and make the necessary modifications to, at least, offer software compatibility (even if hardware plug compatibility is impossible), then the MZ-5600 may stand a better chance of success.

Benchmarks

BM1	1.5
BM2	7.2
BM3	19.8
BM4	20.2
BM5	21.6
BM6	32.8
BM7	53.8
BM8	115.2
Average	34.0

All timings in seconds. For a full listing of the Benchmark programs, see 'Direct Access'.

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with the basic requirements of the current market.

The graphics potential, higher than average mass storage and the user-friendly set-up utilities all bode well for the machine, but to waste so much effort on the implementation of the almost defunct CP/M-86 and sound generation system, is misguided.

> *'. . . the MZ-5600 series has some outstanding aspects but the Japanese designers seem somehow out of touch with the basic requirements of the market.'*

Sharp nearly saved the day with an excellent implementation of MS-DOS but, unfortunately, stopped just short of offering full IBM PC compatibility. A question of pride, maybe?

It would be hard for anyone to deny that the machine would sell far better, in the short term at least, if it were able to run 'off-the-shelf' IBM software.

However, Sharp machines are reliable and have a loyal following as a result. The MZ-5600 series will, therefore, no doubt appeal to users of the MZ-3500 series wishing to upgrade to a full 16-bit machine. Sharp will also be integrating it with products emanating from its other divisions to provide a comprehensive range of office automation products. There are already plans afoot to use the MZ-5600 as the hub of a 'point of sale' system using Sharp cash registers.

As a stand-alone micro the MZ-5600 is competent, but not outstanding enough in any one particular area to get itself noticed in the already confused non-IBM PC compatible market-place.

END

Prices

Before you try to find the cost of a Sharp 5645, whip down to your local home computer store, buy a Spectrum computer and a recently released super-sleuth adventure called Sherlock. You'll definitely need to sharpen up your investigative skills with this classic Melbourne House game before attempting the substantially more difficult task of extracting the Sharp price from either Sharp or any of its dealers. We know: we've tried.

All we did establish was that "a business system including full accounting software and a word processor would sell for less than $8,000 . . . and that might even include a hard disk". So there you have it.

One final point: Sharp does say that if you trot along to one of its dealers, tell them all about your business (ie, "explain your requirements"), they'll tell you how much to cough up for their micro — Ed.

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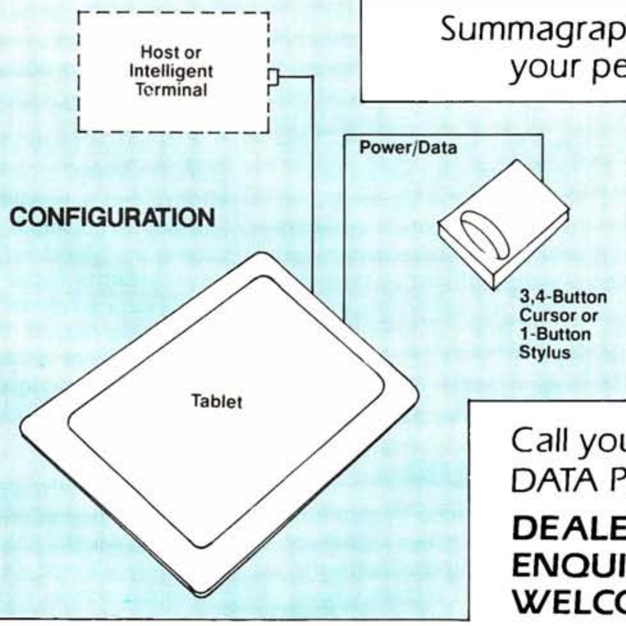
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YANKEE DOODLES

Competition is hotting up in the microcomputer stakes. Our correspondent presents his findings of whom'll be doing what during 1985.

A bit on the small side

Lap-top, knee-top, notebook portable, whatever you want to call it, many US manufacturers are betting their future on the small micro.

Texas Instruments was humiliated with its 99/4A home computer, its portable CC-40 went nowhere, and even its TI Pro was less than enthusiastically received. But its new Pro-Lite seems to be off to an explosive start. The machine is functionally similar to its big brother, the TI Pro, with a 16-bit CPU, 256k of memory, a full 25-line by 80-character LCD screen and a full-stroke keyboard. It differs only in the size of the disk drive — 3.5in on the Pro-Lite — but the Pro-Lite can be connected to an MS-DOS desktop machine for up or downloading of programs and data. Curiously, the machine doesn't come with a battery pack – TI's research revealed that most people don't want true portability but a 'carry around-ability'. Hence, the battery pack is an optional extra. The price is a heady $US2,995.

Another upper-end entry is the Datavue 25. Like the TI, it has a 25-line by 80-character screen, a 16-bit CPU, and 256k of memory. It has a 5¼in floppy disk drive built into the side of the system unit and a detachable keyboard which communicates via an infrared beam like the IBM PC Jr. Like the Pro-Lite, the Datavue is said to be IBM compatible. Base price is around $US2,000.

Three machines from Japanese makers are also fighting for a share in this market — the Sord IS-11C, the NEC 8401 and the Epson PX-8. The PX-8 (Geneva) is already on sale in Australia, but the others are still new. To me, the 8401 looks like a winner. It has a 16-line by 80-character fold-up screen, 64k of RAM, a 300-baud modem, integrated software (WordStar, Calc, Filer, and Telecom), the CP/M operating system, optional memory cartridges and a 3½in disk drive. The price is just under $US1,000.

The Sord IS-11C has a large 25-line by 80-character LCD screen, a built-in modem and microcassette drive, integrated software, 80k of RAM, and much more — all for $US1,500. The machine will initially be aimed at OEMs, a smart move in the light of Sord's lack of marketing prowess in the States.

No optical illusion

Information Storage of Colorado Springs has announced a 5¼in, 100 Mbyte, write-once optical disk drive. The drive has a two and a half million bits per second transfer rate, an average access time of 200 milliseconds, a recording density of 11,500 bits per inch, and a track density of 14,000 tracks per inch.

The drive will use a 13cm optical platter, which is ½in smaller than standard audio compact disks. The media is supplied by Hitachi/Maxell and Sumitomo Chemical. The Sumitomo disks have not previously been seen in the US and are seen as a new move into that market.

Evaluation units for OEMs are priced at $US3,000. However, company president, Steve Popovich, expects prices to drop to $US500 by 1986. Popovich expects the drive will satisfy 'a real need for archival and audit trail data'.

Occupational hazard

With retail stores drying up for all but a handful of microcomputer software companies, specifically makers of the best sellers (for example, Lotus, Ashton-Tate and Software Publishing), makers are analysing the situation as they search out new markets.

The main findings? After implementing word processing, a spreadsheet, and perhaps a database, people don't know what to do with their computers. The answer? Vertical applications.

Studies show that five key occupational groups will account for over half the PC sales in the next three years: engineering and related professions, corporate executives and consultants, small business managers, health care professionals and technicians and, finally, accountants. Currently, there is relatively little software to support these fields directly, so they would appear to be the best niches for smaller software companies to chase. In the future, there won't be much of a market for a new spreadsheet, but a heating efficiency program for a consulting engineer — well, that's a different story.

Break it if you can

Elite Software Systems of Albany, NY, has come up with Encomp, a software encryption system which renders a disk unreadable without the right password. To back up that claim, the company is offering $US10,000 to anyone who can break the system using a personal computer. Entries will not be accepted from mini or mainframe users. The company sent out 6000 entry forms but so far has received only three replies — all of then incorrect.

Random bits

Personal Peripherals, maker of Super Sketch graphics tablets and Super Stik joysticks (for the Commodore and Atari computers), has acquired TG products, makers of joysticks, paddles and related products for Apple and IBM machines . . . Most observers have felt that DEC has come off a decided second best to IBM in the personal computer market. Ken Olsen, president of DEC, admits that the company has failed in the retail market but says: 'We've sold more than we expected in the market we planned the machine for' (smart terminals to the firm's larger computers). Nevertheless, the firm has just cut the prices of Rainbow systems by about 20 per cent. This was 'to remain competitive', according to product manager Barry Folsom, and does not signal a renewed effort to get back into the retail market . . .
Softra, Inc is installing point-of-sale terminals in retail computer stores which make and dispense disks of applications software in about one minute. Retailers like it because it saves inventory stocking costs and the manufacturer likes it because he gets immediate feedback on sales . . . First Byte has introduced Smooth Talker, a speech synthesis package for the Macintosh which reads text directly from the screen without any extra hardware. END

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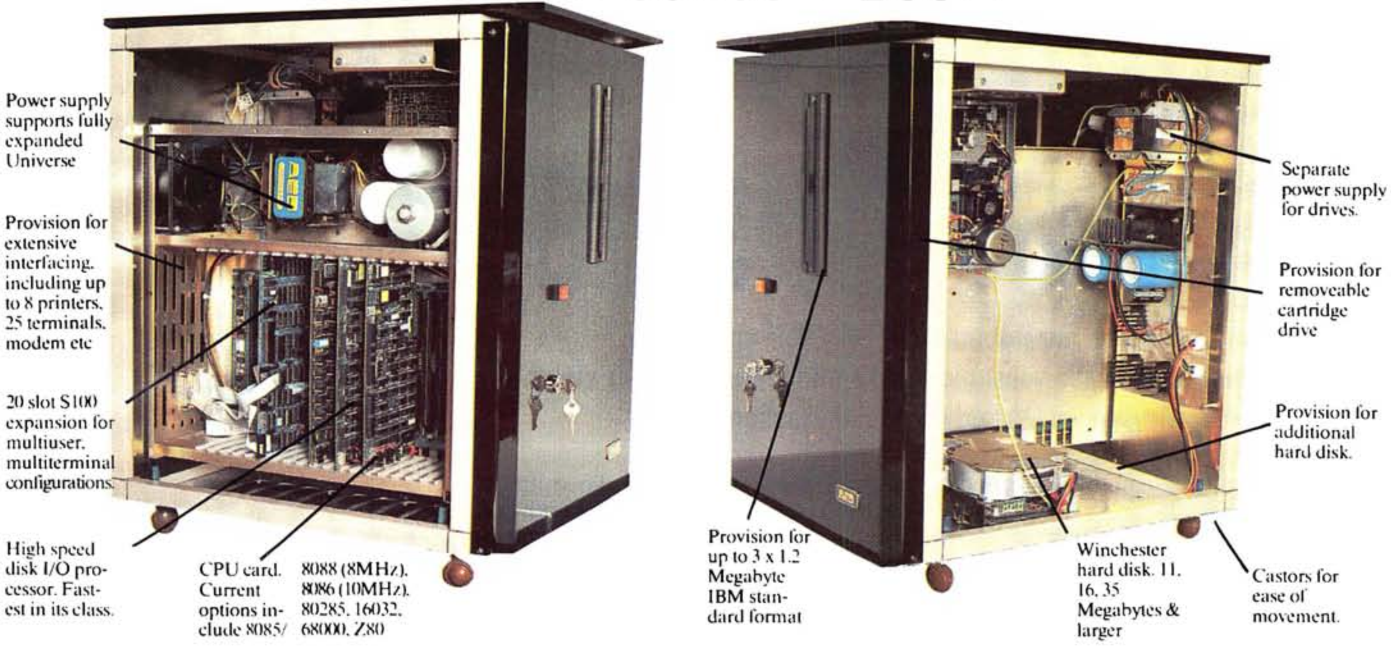
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To see or not to see

Your home movies may not win you any Oscars but editing them with your micro may bring you one step closer.

Robin Luxford directs the action.

Now that 39 per cent of households have a video recorder and a video camera can be bought for about the same cost as a medium size computer, the production of electronic home movies is an attractive proposition. The extremely low cost of tape compared to processed film, the fact that tape can be reused almost indefinitely and the instant replay facility are just a few of its many advantages over film. The main disadvantage, and the factor that retarded the transition from film to tape for some years in the professional world, was the difficulty of editing. The first professional videotape edits were done by coating the edge of the tape with microscopic iron particles to make the magnetic tracks visible, making an accurate cut between frames with a razor blade and joining the pieces in the required order with sticky tape. This was a time-consuming method and one which could not be used with home video formats, or indeed with modern professional formats, because of the narrow angle of the tracks along the tape and the risk of damage to the video heads by the splice.

Gradually the razor blade method was replaced by electronic editing: this simply means that selected sections of the original tape are copied in whatever order required to a second tape, a method known as assemble-editing. This leaves the original tape uncut, the same shots can be copied again to the edited tape which can be erased and reused. The snag (there's always one) is that there has to be some loss of picture and sound quality in the copying process. Although this is discernible with home formats, it's still quite acceptable.

Assemble-editing

To assemble-edit all you have to do is connect the video and audio outputs from the play-in machine to the inputs of another, the record machine, and push the appropriate buttons. Starting with a blank tape in the record machine run the play-in machine first, and just before the beginning of the first shot press the record button in the recording machine, going to pause on that machine at the end of the shot and keeping the record tape in position while you spool through the original tape to a point just before the start of the next shot to be played in. Unfortunately, the reaction time must be measured in microseconds and you need to be familiar enough with the original material to know, say, a second before a car comes round the corner into shot.

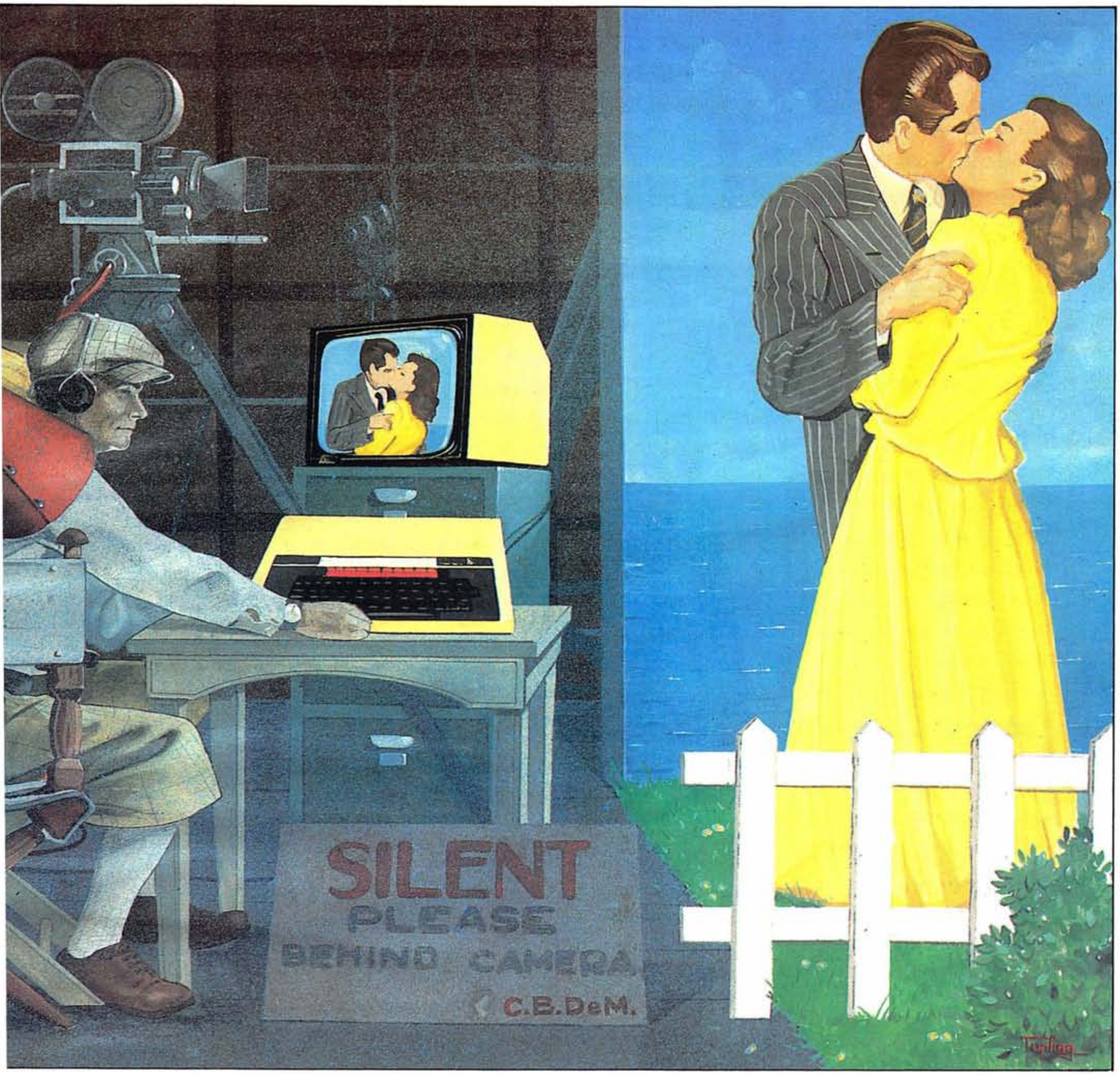
What is needed is some way of uniquely identifying each frame of the original tape, not only so that the numbers can be written down and accurate shot lists compiled, but so that equipment can be developed to recognise the exact moment that a particular frame is being played and start the recording machine. Similarly, it could recognise the 'out' frame and hold the recorder in pause. The professionals invented 'Timecode', a digital signal recorded on a second audio track which carries information relating to hours, minutes, seconds and frames. Microprocessors in their machines were programmed not only to generate the timecode for recording, but to read it in the playback mode and control the machines to position tapes accurately, start and stop recording; in fact, all the functions of their machines.

Application

Now, let's see what we need to make our home computer write and read our own version of timecode and control the machinery. We will confine ourselves to controlling the record/record-pause function of the record machine because we can do this with the minimum of hardware and without delving into the works at all. Most recorders have a camera socket, and included in this will be video and audio inputs and a tape run/stop circuit from the camera trigger which controls the record/record-pause function we need. On VHS recorders, which mainly use a 10-pin camera connector, the relevant connections are as follows:

Pin 1 — video input
Pin 2 — video ground (screen)
Pin 6 — tape run/stop
Pin 7 — audio input (–20db)
Pin 8 — audio ground

When pin 6 is open circuit or below a volt or so, the tape will run. When it is



pulled up to around +4 or 5 volts, the tape will stop. Since these are TTL levels, they are just what we get out of one of the pins of a parallel port. If your recorder does not have a 10-pin plug, you'll have to do a little research on your particular model.

The tape run/stop function on Betamax machines is flipped each time the camera trigger is pressed, so the port output will have to send a short pulse at each run/stop transition rather than remain high or low.

We already have the hardware to send and receive the audio tones carrying the timecode in the form of the cassette interface, so apart from a bit of experimenting with levels, the hardware side of things is under control. In order to record the timecode and still retain the original sound track, a stereo machine is necessary. If you don't have access to a stereo machine and the audio track is needed, it can be copied to sound cassette or tape, edited and copied back to the edited video tape using 'audio dub', after the picture editing is completed. On most stereo machines the audio dub mode records on *one* of the audio tracks only, and it's to the input of this track that we connect the cassette output from the computer. The other machine, the one used to record, does not need to be stereo.

If you have a stereo machine the technique is as follows:

(1) Rewind the original tape to the beginning, run the timecode program in the write mode, press audio dub and leave it to run through to the end of the tape.

(2) Connect the output from the track holding the timecode to the cassette input of the computer and run the timecode program in read mode. Now you can play the tape a number of times to decide on the shots you want to use and to make a list of 'in' and 'out' points. Whenever the tape is playing your VDU will be showing a 'time' in hours, minutes, seconds and frames which exactly identifies each frame.

(3) When you're ready to start copying, connect the two machines with video and audio (not the track with timecode, of course) and the record/record-pause control wire to the computer port. Enter the 'in' and 'out' times for the first shot, press RECORD-PAUSE on the record

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machine and PLAY on the play-in machine.

If you've got the software right everything should happen without a hitch.

Writing the timecode program

My own timecode program runs under CP/M but in order to have the RE output from the modulator on my (quite) unusual machine, the VDU output is sent to the machine's 48-column LCD. My micro's cassette I/O routines are also used but keyboard input is via CP/M; altogether a rather non-standard arrangement. Rather than go into details of this version I'll outline the basic facilities that are needed, together with some possible 'whistles and bells', and ways of providing them.

The program has two modes: 'write' and 'read'. Since it is mainly used in the latter mode this is what is run on initialisation. In this mode the cassette input port is continually scanned and in periods when the flag from the UART indicates that there is no data ready, the keyboard is scanned for a possible command. When a complete code sequence is read from the UART it is first displayed on the screen then compared with the codes held in two stores, the 'run' store and the 'stop' store. If a match is found, a bit of the selected port is set or reset to control the record machine.

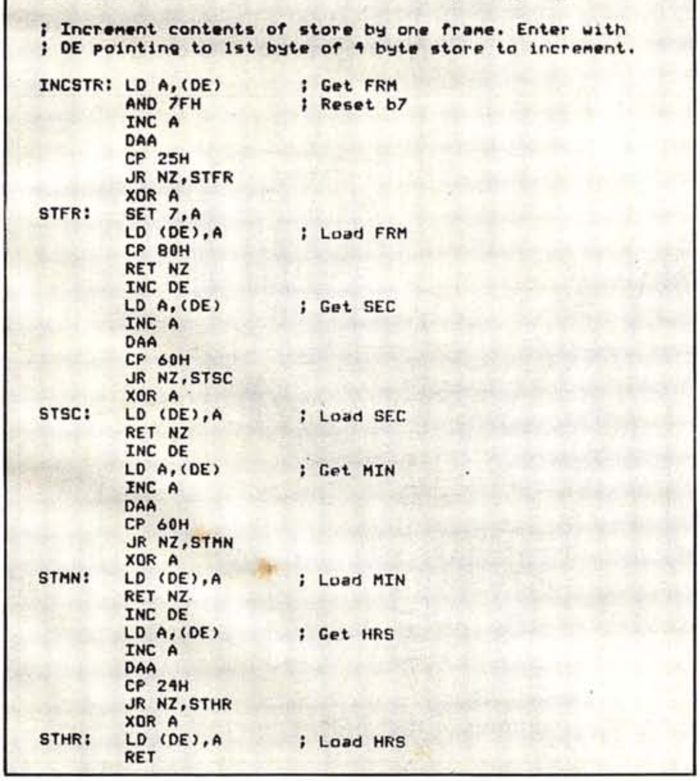
Essential among the commands which can be called from the read mode are routines to enter a timecode from the keyboard to either of the stores, and a command to switch the program to the write mode. Useful additional commands include those which cause the timecode currently being displayed to be entered into either of the stores, commands to increment or decrement either store by one frame, and direct commands which flip the port control bit and thereby control the recording machine manually from the computer keyboard. It is desirable to display the timecodes currently held in the run and stop stores as well as the current tape position code, but since the recorder takes time to run up to speed and switch to record after it receives the trigger signal, the time when it actually starts recording will be after the time held in the run store.

One solution to this is to have two run stores, a 'run displayed time' store and a 'run trigger time' store, the trigger store being always a certain number of frames less (earlier) than the run displayed store. The exact offset can be determined by experimenting with your particular recorder (mine requires 28 frames). Whenever the run displayed time is changed the trigger store is updated by the program — it is the code in the trigger store which is compared with the tape position code, of course. If your VDU has an audible 'bell' signal, it is helpful to sound this when the run displayed time is reached by comparing the run display store contents; this allows you to check the edit point with only the play-in machine running, as a rehearsal.

In the write mode the program runs a loop which generates in hours, minutes, seconds and frames sequence, sends it to the cassette interface at a rate of 1200 baud or more, displays it on the VDU and scans the keyboard for a possible command. The timecode is then incremented by one frame and the process repeatd 25 times per second. There are two ways this timing can be achieved; the perfectionist method uses a simple sync-pulse separator to examine the video signal from the recorder and supply a TTL pulse to an input port corresponding to field syncs, a loop in the program testing for this before continuing. The other way, which does not require any additonal hardware, simply includes a delay loop which is adjusted by trial and error; accuracy of about one second in five minutes can be attained by this method.

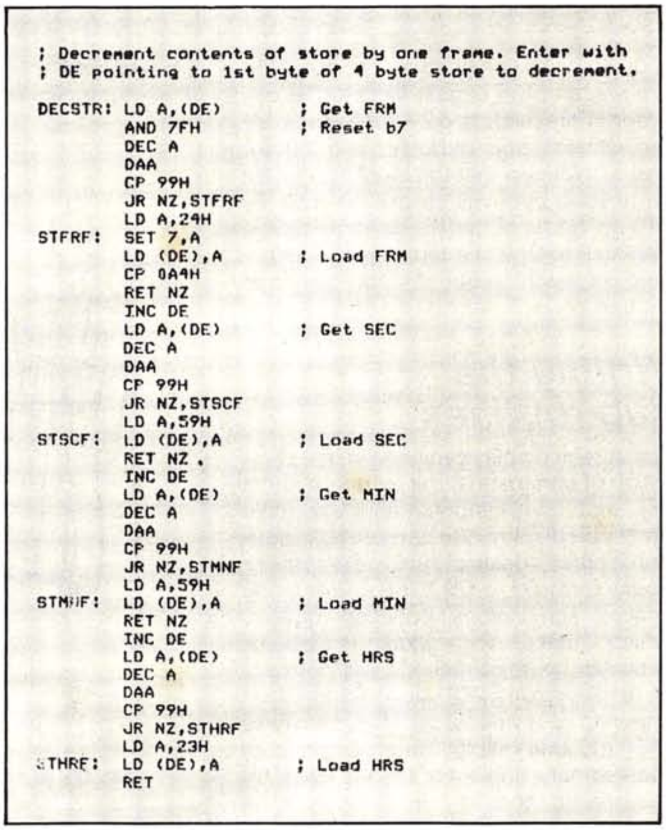
The only essential command to be entered from the write mode is one to switch to read, but commands to write from zero, to write from a pre-set starting time or to continue from the last time held in the main store, are useful.

To make for compact code and fast handling, timecode values are stored as four-byte ECD codes, each byte corresponding to frames, seconds, minutes and hours, in that order. Since binary-coded decimal handles values up to 99


Timecode routines in Z80 assembly language

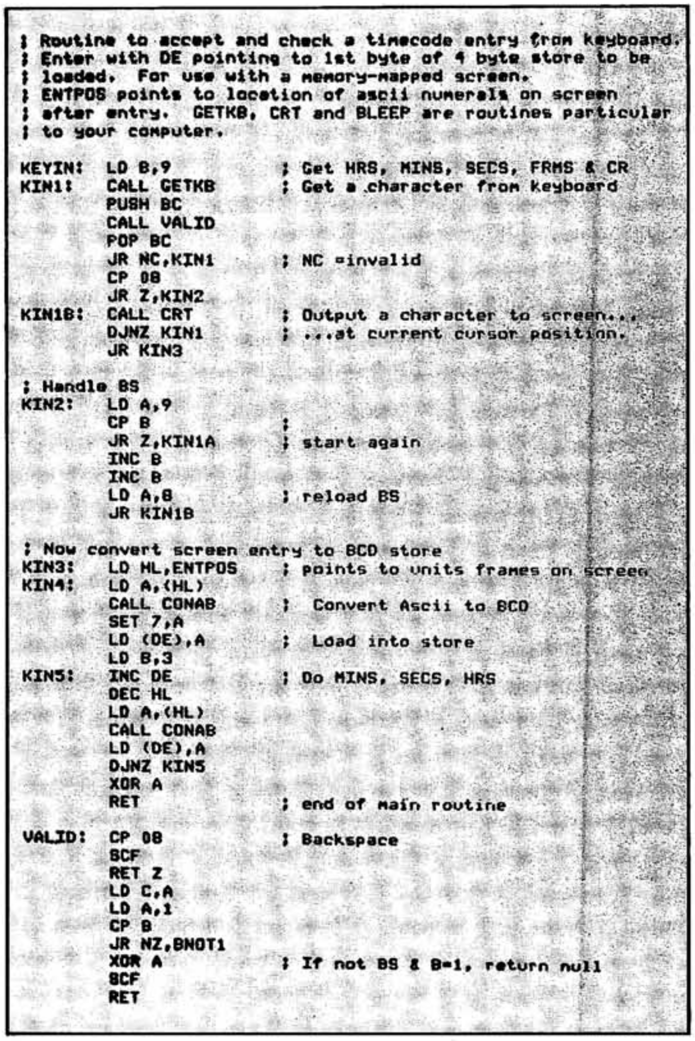
```
; Increment contents of store by one frame. Enter with
; DE pointing to 1st byte of 4 byte store to increment.

INCSTR: LD A,(DE)           ; Get FRM
        AND 7FH             ; Reset b7
        INC A
        DAA
        CP 25H
        JR NZ,STFR
        XOR A
STFR:   SET 7,A
        LD (DE),A           ; Load FRM
        CP 80H
        RET NZ
        INC DE
        LD A,(DE)           ; Get SEC
        INC A
        DAA
        CP 60H
        JR NZ,STSC
        XOR A
STSC:   LD (DE),A           ; Load SEC
        RET NZ
        INC DE
        LD A,(DE)           ; Get MIN
        INC A
        DAA
        CP 60H
        JR NZ,STMN
        XOR A
STMN:   LD (DE),A           ; Load MIN
        RET NZ
        INC DE
        LD A,(DE)           ; Get HRS
        INC A
        DAA
        CP 24H
        JR NZ,STHR
        XOR A
STHR:   LD (DE),A           ; Load HRS
        RET
```



```
; Decrement contents of store by one frame. Enter with
; DE pointing to 1st byte of 4 byte store to decrement.

DECSTR: LD A,(DE)           ; Get FRM
        AND 7FH             ; Reset b7
        DEC A
        DAA
        CP 99H
        JR NZ,STFRF
        LD A,24H
STFRF:  SET 7,A
        LD (DE),A           ; Load FRM
        CP 0A4H
        RET NZ
        INC DE
        LD A,(DE)           ; Get SEC
        DEC A
        DAA
        CP 99H
        JR NZ,STSCF
        LD A,59H
STSCF:  LD (DE),A           ; Load SEC
        RET NZ .
        INC DE
        LD A,(DE)           ; Get MIN
        DEC A
        DAA
        CP 99H
        JR NZ,STMNF
        LD A,59H
STMNF:  LD (DE),A           ; Load MIN
        RET NZ
        INC DE
        LD A,(DE)           ; Get HRS
        DEC A
        DAA
        CP 99H
        JR NZ,STHRF
        LD A,23H
STHRF:  LD (DE),A           ; Load HRS
        RET
```



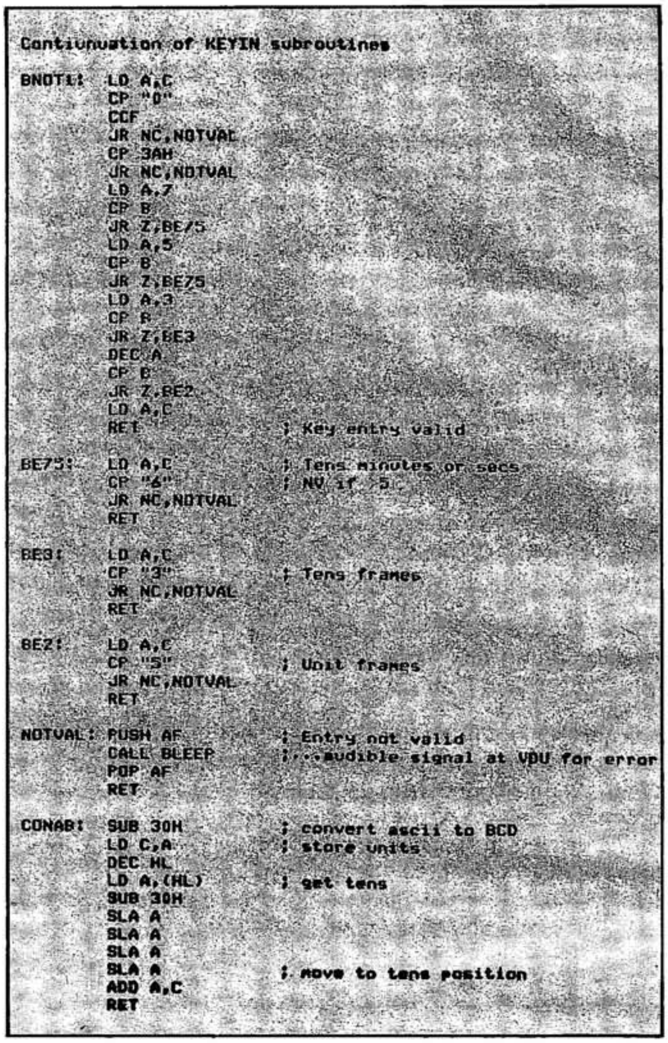
```
; Routine to accept and check a timecode entry from keyboard.
; Enter with DE pointing to 1st byte of 4 byte store to be
; loaded.  For use with a memory-mapped screen.
; ENTPOS points to location of ascii numerals on screen
; after entry.  GETKB, CRT and BLEEP are routines particular
; to your computer.

KEYIN:  LD B,9              ; Get HRS, MINS, SECS, FRMS & CR
KIN1:   CALL GETKB          ; Get a character from keyboard
        PUSH BC
        CALL VALID
        POP BC
        JR NC,KIN1          ; NC =invalid
        CP 08
        JR Z,KIN2
KIN1B:  CALL CRT            ; Output a character to screen...
        DJNZ KIN1           ; ...at current cursor position.
        JR KIN3

; Handle BS
KIN2:   LD A,9
        CP B                ;
        JR Z,KIN1A          ; start again
        INC B
        INC B
        LD A,8              ; reload BS
        JR KIN1B

; Now convert screen entry to BCD store
KIN3:   LD HL,ENTPOS        ; points to units frames on screen
KIN4:   LD A,(HL)
        CALL CONAB          ;  Convert Ascii to BCD
        SET 7,A
        LD (DE),A           ;  Load into store
        LD B,3
KIN5:   INC DE              ; Do MINS, SECS, HRS
        DEC HL
        LD A,(HL)
        CALL CONAB
        LD (DE),A
        DJNZ KIN5
        XOR A
        RET                 ; end of main routine

VALID:  CP 08               ; Backspace
        SCF
        RET Z
        LD C,A
        LD A,1
        CP B
        JR NZ,BNOT1
        XOR A               ; If not BS & B=1, return null
        SCF
        RET
```



```
Contiunuation of KEYIN subroutines

BNOT1:  LD A,C
        CP "0"
        CCF
        JR NC,NOTVAL
        CP 3AH
        JR NC,NOTVAL
        LD A,7
        CP B
        JR Z,BE75
        LD A,5
        CP B
        JR Z,BE75
        LD A,3
        CP B
        JR Z,BE3
        DEC A
        CP B
        JR Z,BE2
        LD A,C
        RET                 ; Key entry valid

BE75:   LD A,C              ; Tens minutes or secs
        CP "6"              ; NV if >5
        JR NC,NOTVAL
        RET

BE3:    LD A,C
        CP "3"              ; Tens frames
        JR NC,NOTVAL
        RET

BE2:    LD A,C
        CP "5"              ; Unit frames
        JR NC,NOTVAL
        RET

NOTVAL: PUSH AF             ; Entry not valid
        CALL BLEEP          ;...audible signal at VDU for error
        POP AF
        RET

CONAB:  SUB 30H             ; convert ascii to BCD
        LD C,A              ; store units
        DEC HL
        LD A,(HL)           ; get tens
        SUB 30H
        SLA A
        SLA A
        SLA A
        SLA A               ; move to tens position
        ADD A,C
        RET
```

in one byte by considering it as two 4-bit groups, and the largest values that can occur in timecode are 24 for frames, 59 for seconds and minutes, and 23 for hours, it follows that the most significant bit in each byte will always be zero. By setting this bit of the 'frames' byte before writing it to tape, we can mark the beginning of each sequence for the read routine.

Writing the sub-routines

The screen display can consist of a short menu of commands, the contents of the 'go' and 'stop' stores, and the main timecode display; the current tape position. This can be displayed in the conventional form 01 : 59 : 59 : 24 using spaces and colons between figures, which make for good readability. However, as the timecode will normally be displayed on a VDU alongside a TV set showing your videotape, it helps to make the timecode display much larger than the ordinary character height used for the menu, and so on. This can be achieved with most computers by using screen-graphics routines.

The routines to compare the current tape position with the contents of the

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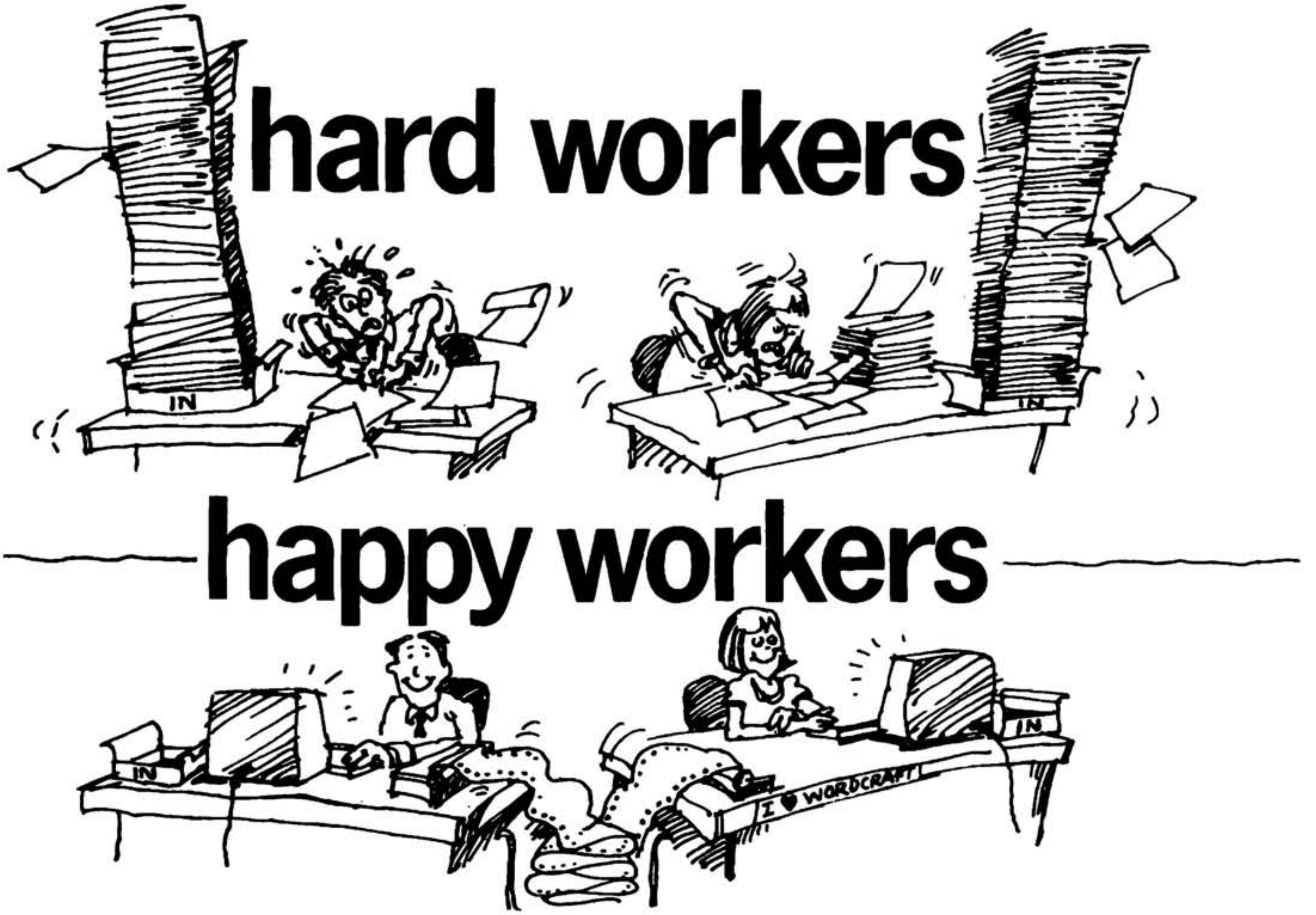

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various stores are simply two successive 16-bit subtractions, returning a zero flag if a complete match of all four bytes is found. The routine to enable a timecode to be entered from the keyboard to the run-display, the stop or the current store, needs to convert each pair of ASCII values (tens and units) to one BCD value, set bit 7 if it's the frame byte and store it. Ideally, some form of error checking should be included to prevent non-numerals or values larger than the maximum being entered.

The 'increment by one frame' routine, used both as a command and by the write routine, utilises an increment instruction followed by a decimal accumulator adjust instruction to convert from binary to BCD on the contents of the frame store.

This is followed by a check to see if the value of 25 has been reached; if so, the figure is set to zero and the contents of the seconds store incremented and compared with 60, the process continuing for up to 24 hours. The decrement routine is similar except that after decrementing and decimal adjusting each value it is compared with 99.

The routine to write timecode to and read it from tape can be adapted from the cassette routines in the operating system. When the UART is busy, the keyboard should be scanned for a possible command.

Potential

If you can devise a way of synchronising the video output of the computer with the videotape playback, it's possible to make a straight, unedited copy of the original material with the original sound and the timecode display inserted in the picture. This is known as a viewing copy, and enables you to use slow-motion playback to examine the action very carefully and select the exact frame number. Once this viewing copy is made, the original tape is not used again until the final editing session, saving it from the risk of accidental erasure when running the tape to and from compiling the shot list.

The method I use is to have a black and white camera, driven by sync-pulses derived from the playback machine, looking at the timecode display on the VDU. The camera output is then inserted into the picture by a 'video camera selector', an inexpensive device made by Sony for inserting captions into home videos. Although this may sound cumbersome, it works well, and by moving the camera the timecode may be positioned anywhere in the picture. In professional use, it is usually placed about a fifth of the way up from the bottom of the frame.

It's easy to overlook the sound aspect by concentrating on achieving immaculate picture edits. In some cases, such as a video made to a piece of music, the sound recorded with the picture is discarded, but when it is copied with the picture it helps to use a simple audio mixer between the play-in and record machines to control levels. In any case, because the output from the play-in machine is around −6db and the input level of the record machine is around −20db, it is desirable to attenuate the feed by about 14db to prevent the automatic gain control circuit in the record machine from spoiling your artistic efforts. Any really elaborate treatment of the sound is probably best done after the picture editing, using the audio dub facility.

Thanks to my colleague, Geoff Higgs, a former videotape editor and fellow Z80 machine code enthusiast.

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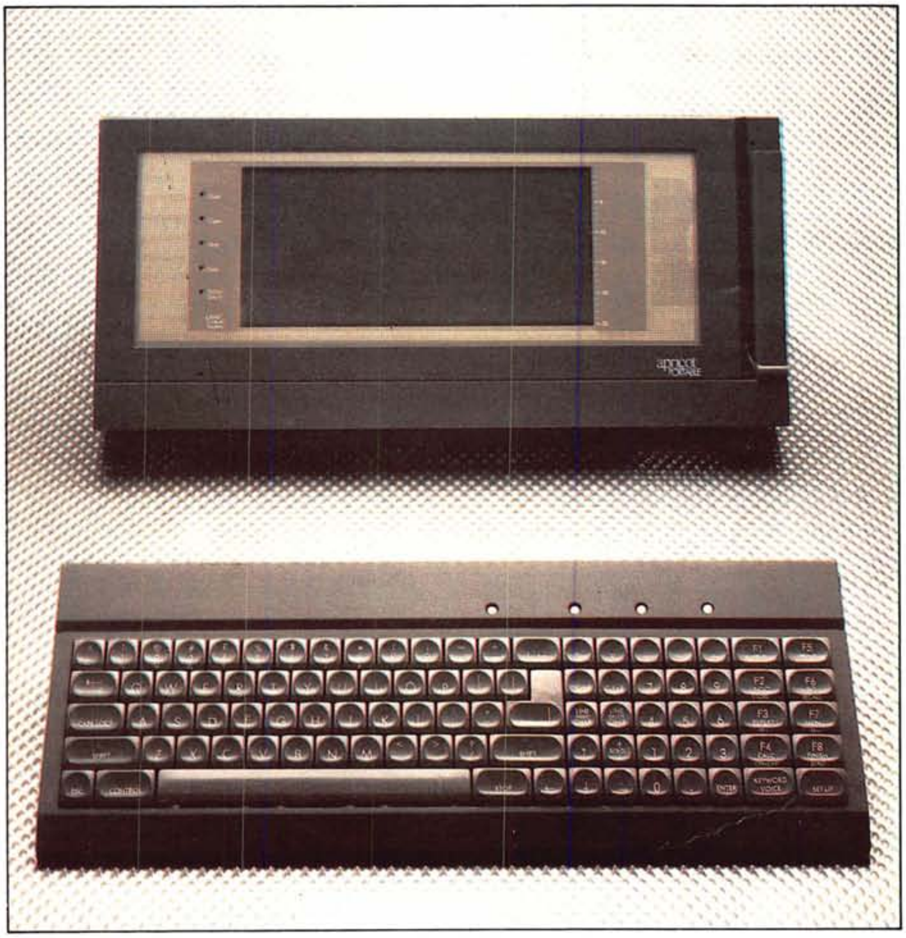
Apricot Portable

Providing a lower entry level into the ACT range the Apricot Portable has some novel features to be proud of — one of which is a speech recognition facility as 'standard'. Unprecedented on a micro, Peter Bright wonders how useful this, as well as the machine's other innovative features, will be.



The Apricot Portable is one of two machines recently launched by ACT. The other machine was the Apricot F1 (Benchtested last November). While F1 is not the most informative of names (it stands for First One), the Portable's title is at least self-explanatory.

The Portable certainly looks very innovative, with a 25-line by 80-column liquid crystal screen, built-in voice recognition, an infra-red keyboard and 16-bit computing power for $4725.

Hardware

The brochure lists the Portable's dimensions as 450mm long x 172mm wide x 200mm high. In real terms this means that it is larger than lap-held machines but much smaller than conventional desk-top or transportable machines. It is one of the few micros that I can think of which can happily sit on a desk without totally dominating the available space. Its lack of bulk also means that you can strap it into its hard carrying case and still have room left for a printer and assorted bits and pieces.

A look at the photograph will show that the Portable looks very unusual. The 25-line LCD display dominates the front of the unit with the single disk drive hiding away along the right-hand side. The microphone for the speech recognition unit is clipped to the front of the unit and can either be used there or unclipped and held in the hand.

Along the back there is nothing to be seen apart from the power socket and a massive great heat sink. I/O ports are conspicious by their 'apparent' absence. In fact they are just hiding and can be accessed by removing a large cover which runs halfway along the back.

The Portable is not exactly overrun with I/O ports, just one centronics parallel, one RS232 serial, one for the RGB monitor and one Apricot-compatible expansion slot. The most likely card for the expansion slot is either ACT's modem card (Telecom approval is pending) which allows access to remote dial-up services or one of its RAM expansion cards.

Getting inside the Portable is easy — just undo two screws and pull the front panel off. The first thing you notice is how closely packed the PCBs are. And the second noticeable thing is that there isn't a CMOS chip in sight. Absolutely no attempt has been made to allow this machine to run off batteries — it's strictly mains only. ACT thinks that CMOS technology is still too expensive to be viable in the portable price range and volume. A pity.

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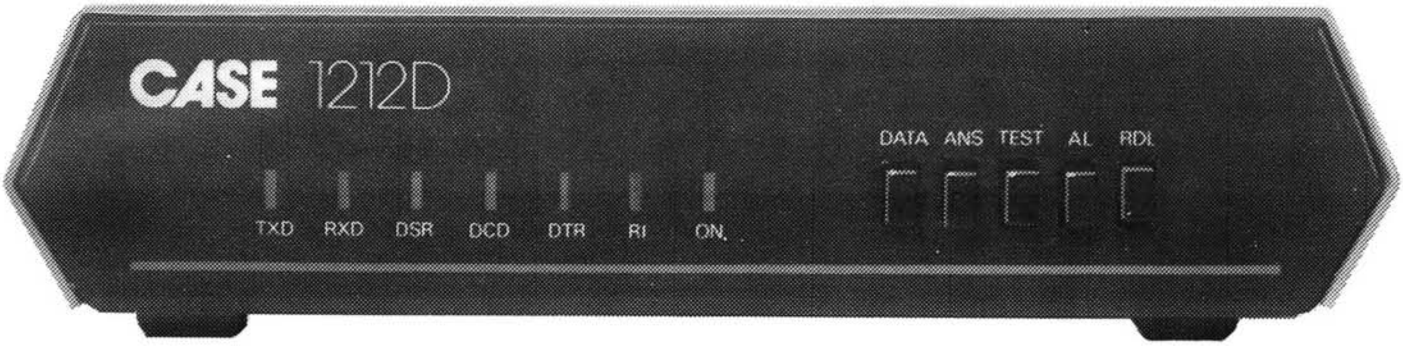

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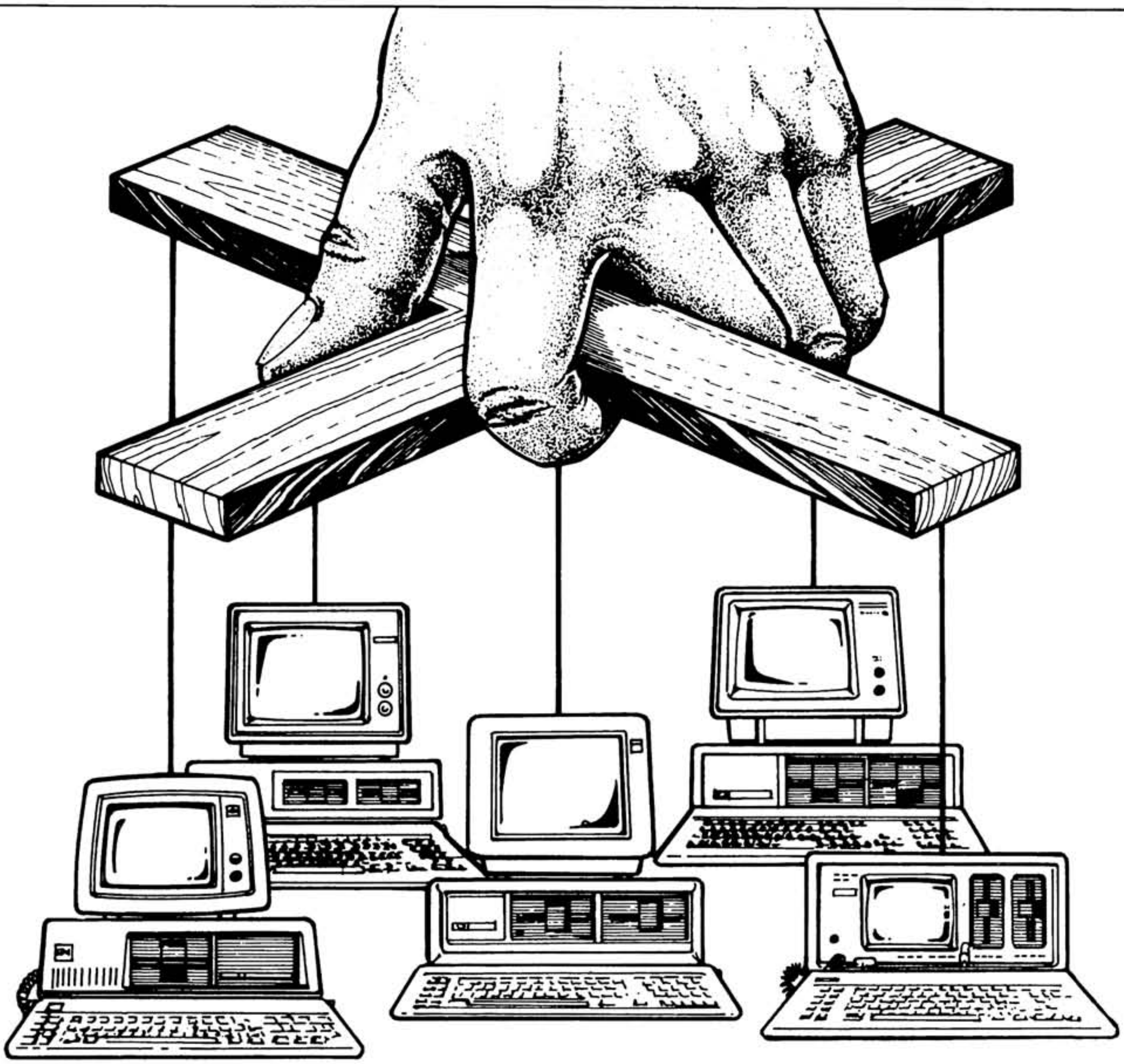

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The PCB on the back of the LCD display is covered with 20 'flat pack' decode chips. These are square and unlike conventional DIL chips have pins on all four sides — much like the new Intel iAPX 186 & 286 CPU chips.

There are two main PCBs inside the Portable. The first fills the front of the unit and houses the main processor, RAM, ROM, display circuitry and the expansion bus. The board was well-made with little patching in evidence.

The board on the review machine used 32 Texas Instruments 64k x 1 RAM chips to give a total of 256k onboard. However, it is wired for 128k x chips, so you could have 512k if required. Unfortunately this is only available as a factory option, it isn't a field upgrade job. The board also contains 32k of operating system ROM.

The processor is an Intel 8086 clocked at a fairly sedate 5MHz rather than the decidedly odd 4.77MHz of the F1.

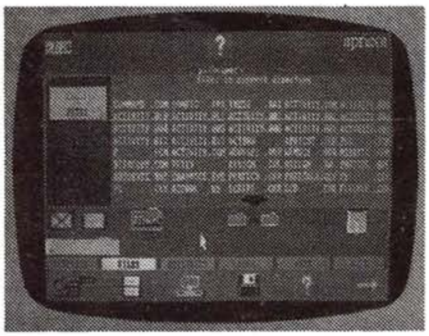
The second board handles the RS232 and centronics ports, takes the output from the infra-red keyboard link and also takes the input from the microphone for the speech recognition. All in all the electronics are well up to ACT's usual high standards in terms of construction and ease of servicing.

The disk is located on the right-hand side panel. It follows standard ACT practice — Sony 3.5in, double-sided 720k. It worked fine in use (as have all the Sonys I've used). If you are going to be handling large quantities of data, the second half of this year should see a nifty little external 10Mbyte Rodime 3.5in hard disk called an MSD (Mass Storage Device).

The display is one of the major features of the Portable. As far as I know, it was the first production machine to use a full 25-line liquid crystal display. The display unit is made in Japan by Hitachi, but ACT wasn't happy with the controller, so it designed its own (very fast) display controller chip.

LCD resolution is the best I've ever come across. In text mode it can display 80 characters x 25 lines, while in graphics mode 640 x 200 pixels. Thanks to the dedicated controller, the LCD is also very fast.

LCD displays have two major advantages for portable machines. Firstly, they use very little power and so lend themselves to battery power. Secondly, they are virtually flat and, therefore, use much less space than a conventional cathode ray tube. This LCD wasn't gone for because of its low power consumption (the rest of the system eats power), but because of the space advantages. By using the LCD it has been possible to pack the display and the two main PCBs into a unit little thicker than an average paperback book. Impressive. The trouble with LCDs is that they aren't always easy to read. Whereas CRTs actually give off light, an LCD display can only reflect light shining onto its surface. This has two effects: firstly, if there isn't much light around, you won't be able to see the display; and secondly, even if there is enough light, you risk getting all sorts of nasty reflections back from the display.


'File' allows normal housekeeping

Most micros which use LCDs try to get around these problems by allowing you to alter the tilt of the display and by providing for alterations in the contrast of the display. Although the Portable allows you to alter the contrast by holding down the SHIFT and UP-ARROW or DOWN-ARROW together, the angle of the display is fixed and there isn't anything you can do about it.

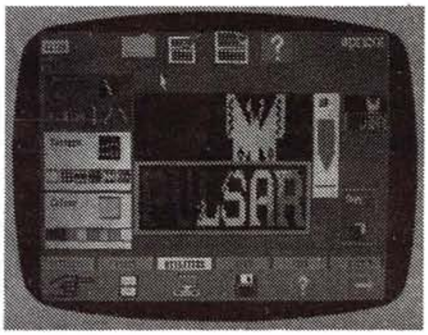
The upshot of all this is that display quality on the Portable can be appalling or acceptable — depending on how careful you are when you position the unit.

The manufacturer rationalises this problem by saying that the LCD display was intended to be used away from base. Back at base you would plug into the optional colour monitor and use that instead of the LCD.

The colour display is, in fact, very good. Its resolution of 640 x 256 pixels is higher than the LCD and it can also display up to eight colours simultaneously out of a palette of 16 on the screen. If you have the colour option, an extra 128k of dedicated video RAM is added to the system.

As with the F1, the Portable makes heavy use of Digital Research's GSX graphics extension to ensure that applications programs are compatible across the range. This means that so long as your applications software uses GSX you can run it up on either the LCD or the colour display, even though they have different resolutions and the LCD can only display black and white. All you need to do is install the appropriate GSX driver. (For more details see the F1 Benchtest.)

In addition it is also possible to display data on both displays at the same time. For example, if you are using Supercalc 3 you can display the spreadsheet model on the LCD at the same time as displaying graphs or pie charts on the monitor.


Create ikons and save them to disk!

The keyboard is exactly the same as the one used on the Apricot F1: that is to say, it's a 92-key membrane unit with 10 function keys and a numeric keypad.

Anyone who read the F1 Benchtest will know that I'm not too keen on this type of keyboard. I don't like membrane keyboards, and even though this is a good one, it still doesn't have the feel of a good 'traditional' unit. Also the space-bar doesn't register until it's below the level of the keyboard casing. This gives your thumb a very hard time when you are touch-typing.

The keyboard's main claim to fame is not its keys but its infra-red link with the main unit. This does away with the traditional cable and uses a light beam to send each 32-bit keycode.

As with the F1, I found that this link either worked or it didn't — it never got the key wrong. The trouble is that I'm still trying to think of the advantages of infra-red as opposed to good old cable.

The Portable is also available with an infra-red mouse. This is a very large mouse/trackball arrangement which is useful when used in conjunction with the new user-friendly applications packages.

Unfortunately, the infra-red mouse supplied with the machine wasn't feeling well and refused to work. I had the same trouble with the F1 — though this review machine was an early version and Barson Computers (the Australian importer) assures me there's no problem with machines now in the shops. Anyway, it had to go to the vet, so I ended up using a Microsoft mouse plugged into the RS232 port. Apparently all the necessary driving software is buried somewhere in the GSX driver, so this could be a good alternative to ACT's offering. The Microsoft mouse worked faultlessly.

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AS005

Portable is available with MS-DOS Version 2 and/or Concurrent CP/M Version 3. The review machine was supplied with MS-DOS 2.11. Nothing strange to report.

What is much more interesting is that the Portable is also shipped with the 'Activity' front-end to the operating system. Those of you who have used an Apricot before may remember the 'Manager' front-end which used to be shipped. I am happy to report that Activity is much better than that and it's a very useful alternative to the MS-DOS command line.

I looked at Activity in some depth in the F1 Benchtest (see November *APC*). Three new features which weren't there are 'Help', 'Files' and the 'Ikon Editor'.

The 'Help' ikon is a large question mark at the top of the screen. Selecting Help attaches a little box to the end of the cursor arrow which you then move to the area with which you are having trouble and an appropriate Help message appears. This is very impressive.

If the Help isn't enough, press the button twice over the Help ikon and you will be taken to a self-teach tutorial! Help is available wherever you go, but I found that after 10 minutes using the system it was so straightforward that it became unnecessary.

The 'Files' ikon wasn't implemented on the old version of Activity. It allows you to copy, rename and delete files and to move around, create and delete subdirectories.

The central part of the screen shows a list of the files on the current disk. To its left are a number of named filing cabninet drawers. These represent subdirectories. Below the file list are ikons for rename and copy, a dustbin for delete, and ikons for creating and deleting sub-directories.

To select the file you want to work on, you can either type its name or you can highlight it in the list of files. To perform the operation, drag the file to the desired ikon.

All in all this area of Activity has been well executed. The only times I had to descend into MS-DOS were to TYPE a file and to copy a file to a sub-directory. Although the Files option allows you to play with sub-directories, my version wouldn't let me copy files to or from a sub-directory.

The third new feature is the Ikon Editor, which again wasn't operative on the last version. This is a fairly basic painting program which allows you to create ikons which can subsequently be attached to application programs for display on the main Activity screen.

On the colour screen, the Ikon Editor allows you to choose from six different brush shapes, six different fill patterns and eight different colours. Like all painting programs you can have hours of endless fun playing with different pictures.

Applications software

The Portable is supplied with a great deal of bundled software — SuperWriter, SuperCalc, Diary, Sketch and an interactive tutorial. Barson Computers says the majority of standard Apricot software will run provided it doesn't make direct calls to the hardware.

The last main claim to fame of the Apricot Portable is that it boasts built-in speech recognition. Most speech recognition systems rely on highly expensive, complicated hardware to sample and process the signal from the microphone. The Portable's speech system relies instead on highly complex algorithms built into the software. This makes it economical to build speech into a budget product.

The recognition system can work in two ways: simple and complicated. In its simplest form the output from the recognition is just dumped into the keyboard buffer. This can be used with most applications programs because the program just thinks you've typed the command in. The second method is to write the applications program with voice recognition specifically in mind. This obviously allows you to do more, but the software is likely to be quite specialised.

The voice system on the Portable allows you to have a vocabulary file of up to 4096 words. However, only 64 words can be held in RAM at any one time, so a fair amount of shuffling is necessary with large vocabularies.

Before the system can understand your commands, it is necessary to create a vocabulary file and train the system to understand your voice. The Portable is supplied with a program which allows this to be done.

The first thing to do is to create a vocabulary disk file. You can have as many of these as you like. The training program prompts for a name and then opens a disk file under that name with a .VOC extension.

Next you enter the words you want to use, together with an optional command which you want the machine to respond to. Once you have entered all the words, you can go into training mode. To do this you speak the words into the microphone and the program records the voice patterns. The more times you repeat each word the better the result.

After you have trained all the words you can go on to see how well the machine understands you. I found that the majority of words worked straightaway but some needed more effort.

By way of a test I had a go at teaching the Portable ***Mary had a little lamb.*** It did pretty well but had problems with the difference between 'had' and 'and'. I think many of the problems I encountered were associated with the microphone — it's a cheap electret type and I had to virtually swallow it to get the machine to register my voice. This in turn induced stress in my voice which didn't do much for accuracy.

Documentation

Final versions of the documentation were not available with the review model, except for an applications manual covering Superwriter, SuperCalc and SuperPlanner, and a Microsoft manual covering MS-DOS and GW-Basic. Both are attractive presentations of fairly standard information.

Prices

A basic machine with 256k of RAM costs $4725. A colour display with an extra 128k of video RAM and a mouse will add $560. All prices include sales tax.

Conclusion

When I looked at the F1 it was easy to write the conclusion — the machine was cheap and offered value for money as a small desk-top machine which was also transportable.

Things aren't nearly as clear-cut with the Apricot Portable. Although it's got more bells and whistles, it isn't obvious who will want them. Let's take the features one by one.

The 25-line LCD display is light and compact, yet the machine requires mains power. This isn't necessarily a bad thing as most users will no doubt carry out their 'heavy computing' back at base with lots of power and a colour monitor for easy readability. The LCD will probably only be used on occasional forays out of the office to impress clients. I think the LCD is also a statement of intent from ACT. Maybe the next machine will be a CMOS machine with a colour LCD?

The infra-red keyboard link is a marketing gimmick, but the voice recognition capability is potentially very useful. Much depends on how accurate the system proves. I would hate DIR to be interpreted as FORMAT! If ACT does achieve the 99 per cent accuracy it is striving for, then the machine will undoubtedly bring respectability to voice recognition.

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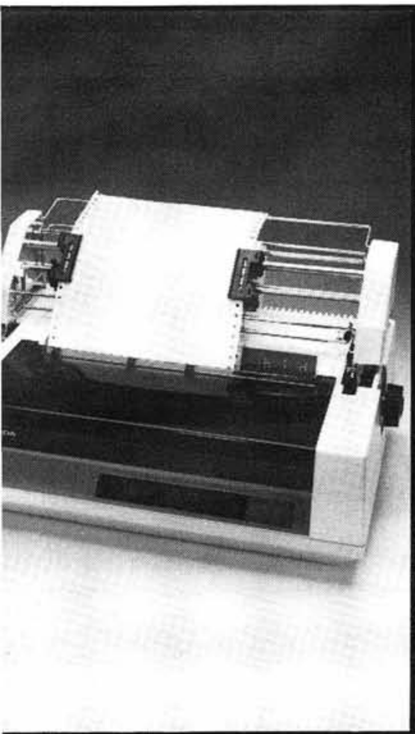

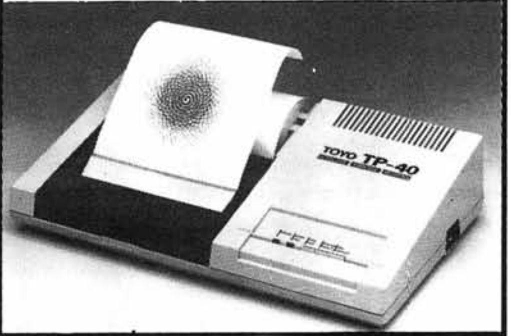

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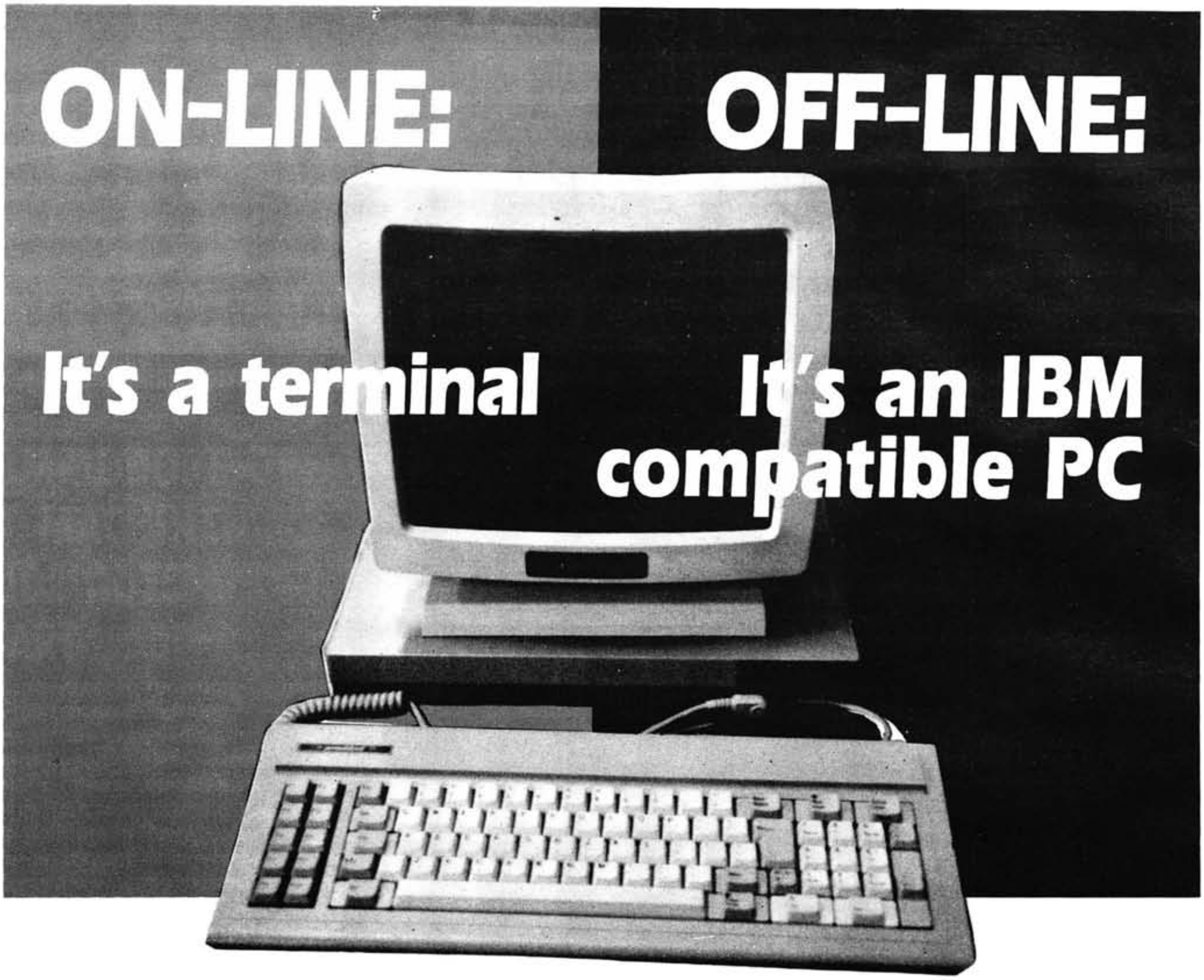

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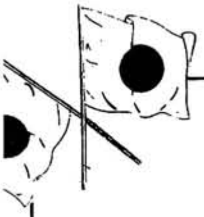

ORIENT EXPRESS

Conservation hits the industry and there are lots of new machines and peripherals on the Japanese scene, as Shinichiro Kakizawa reports.

What's new?

Lots of new micros have been announced in Japan recently, and some may already be available in Australia.

There's IBM Japan's PC twin JX series, now in the shops and selling well. And the market leader, NEC, with more than 50 per cent of the Japanese micro field, has launched a series of new 16-bit models in its PC-9800 range.

This includes a 10Mbyte hard disk drive as standard, and the PC-9801/F3 which features 256k main memory and two 1Mbyte 5¼in floppy disk units as standard options.

These NEC announcements are obviously intended as a counter-punch to the IBM JX machines. The company has also announced several improved versions of its lower-end, 8-bit PC-6000 series. The new models are the PC-6001 Mark 1 SR and PC-6001 SR, and both units offer more RAM space and choice of peripherals than the older models. Incidentally, NEC offers no MSX machines.

Canon has released a new 16-bit workstation/micro, the AS300. It's the most powerful model within Canon's 16-bit range, and can be used as a Japanese/English word processor, a micro and terminal, and Canon's own integrated software, Super Canon Eleven, is available to supplement it. The IBM 3270 protocol is also supported by Super Canon Eleven. The basic system costs around $2400; Super Canon Eleven costs $500.

Sony has launched two new MSX machines for home/games users. The model HB-101 is for beginners, and the HB-701 is aimed at more advanced users who want to control their video and stereo equipment.

The HB-101 is the successor to Sony's first MSX machine which was launched in December 1983. The major improvements are its more user-friendly appearance, and the inclusion of packaged software which offers a personal schedule management program, a simple memo writer, and a database-type program for storing addresses and telephone numbers. The basic model has 16k RAM expandable to 64k.

The more powerful model, the HB-701, has a 'superimpose' feature which places pictures, and a series of characters generated by the micro, onto video film. Built-in graphics software enables the user to construct colourful images. An additional capability is that existing equipment can be attached through Sony's optional interface unit.

The basic HB-701 model, without the 3½in disk unit, costs $500, and is evidence of Sony's continuing strategy of combining micros with audio/video equipment.

Sharp has announced a new model of its popular X1 personal computer TV. The X1-Turbo has upward compatibility with the older X1 TV, and improvements include: 640 x 400 dot full colour mode; a paint feature 30-40 times faster than the older model; a superimpose option; automatic switching from low resolution to high resolution on the TV; and a 1000-character display on the same screen.

The basic model, which includes a processor/keyboard and a colour display unit, costs $2,000.

Sharp has also launched another new portable computer, the PC-2500. A plotter/printer which operates with four colours on 114mm paper is included, and the LCD screen displays 150 x 32 dots. Using the RAM card, the maximum main memory size available to the user has expanded to 21k. The PC-2500 costs $420 here in Japan.

Hitachi has announced a new MSX machine, the MB-H2. Its most attractive feature is the inclusion of a stereo cassette deck, with which automatic selection and playback can be programmed. A simple digitiser tablet can also be attached so that input of graphics is easier.

Hitachi intends to sell the machine to the educational market, as it can be used for entertainment: for example, producing children's picture book-type sequences.

Some peripherals have been launched, too.

Pioneer has announced an MSX Extended Processor, the ER101, which will enable any MSX machine to connect with laser/video disk players. The ER101 can be linked to MSX machines with a capacity of over 32k. In addition, a new game, Laser Game, will be available soon from Pioneer. The ER101 costs $240.

Century Planning Ltd, a Tokyo-based company specialising in unique peripheral equipment for micros, is selling a bar code reader together with paper software for MSX micros.

Current MSX programs either take the form of ROM cartridges, floppy disks or cassette tapes, but Century's paper software comes in bar code form.

To run a program, you have to buy the bar code reader and a book of paper software, and input the program by scanning the book using the bar code reader.

The cost of the bar code paper software is just a fifth of a ROM cartridge and a third of a cassette tape. The reader costs $150, but once bought, you can enjoy the cheap paper software indefinitely — sounds reasonable! A book containing five to 10 bar code sheets costs $12.

Waste not, want not

Cheap, continuous computer stationery made of recycled paper is now available in Japan. A large department store chain and a waste paper collection/recycling firm have jointly developed a 'natural resource conservation' computer paper.

There's nothing wrong with the appearance of the recycled product, which is somewhat similar to cheap writing paper with its 'rough book' surface. But compared with ordinary computer paper, it looks a little shabby.

However, it costs 40 per cent less than ordinary paper at $6 per 500 sheets.

For non-recycled paper, the same number of sheets would cost more than $11.

Let your machine do the walking

There is now available, free of charge, an automatic dialling machine which stores up to 3200 different telephone numbers.

Too good to be true? Yes and no. You can certainly have the machine for nothing. The catch is that you can't choose the telephone numbers to be stored. In fact, all 3200 numbers are already programmed in when you buy the machine.

The cost of the machine/directory will be paid by the maximum 3200 sponsors whose numbers are stored in the ROM.

The free automatic telephone directory is available from Great Japan Computer Systems of Tokyo.

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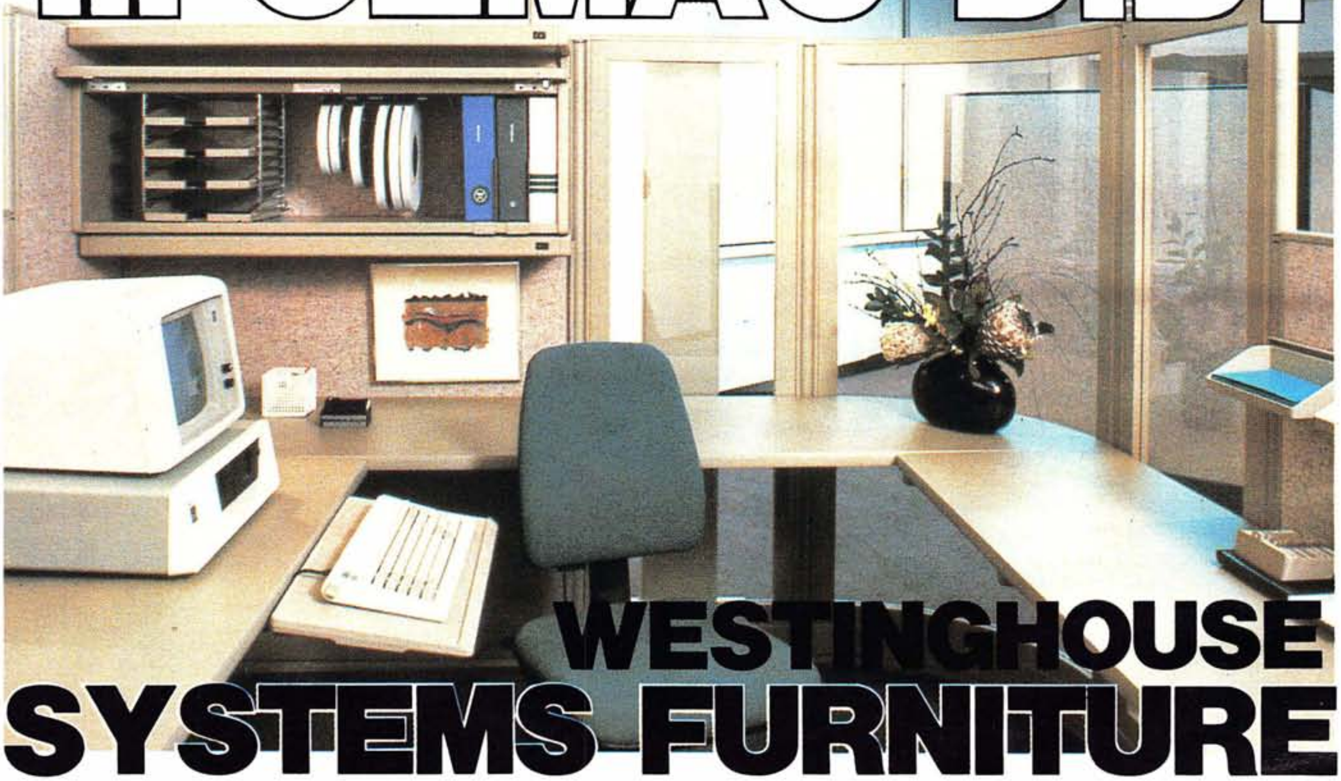

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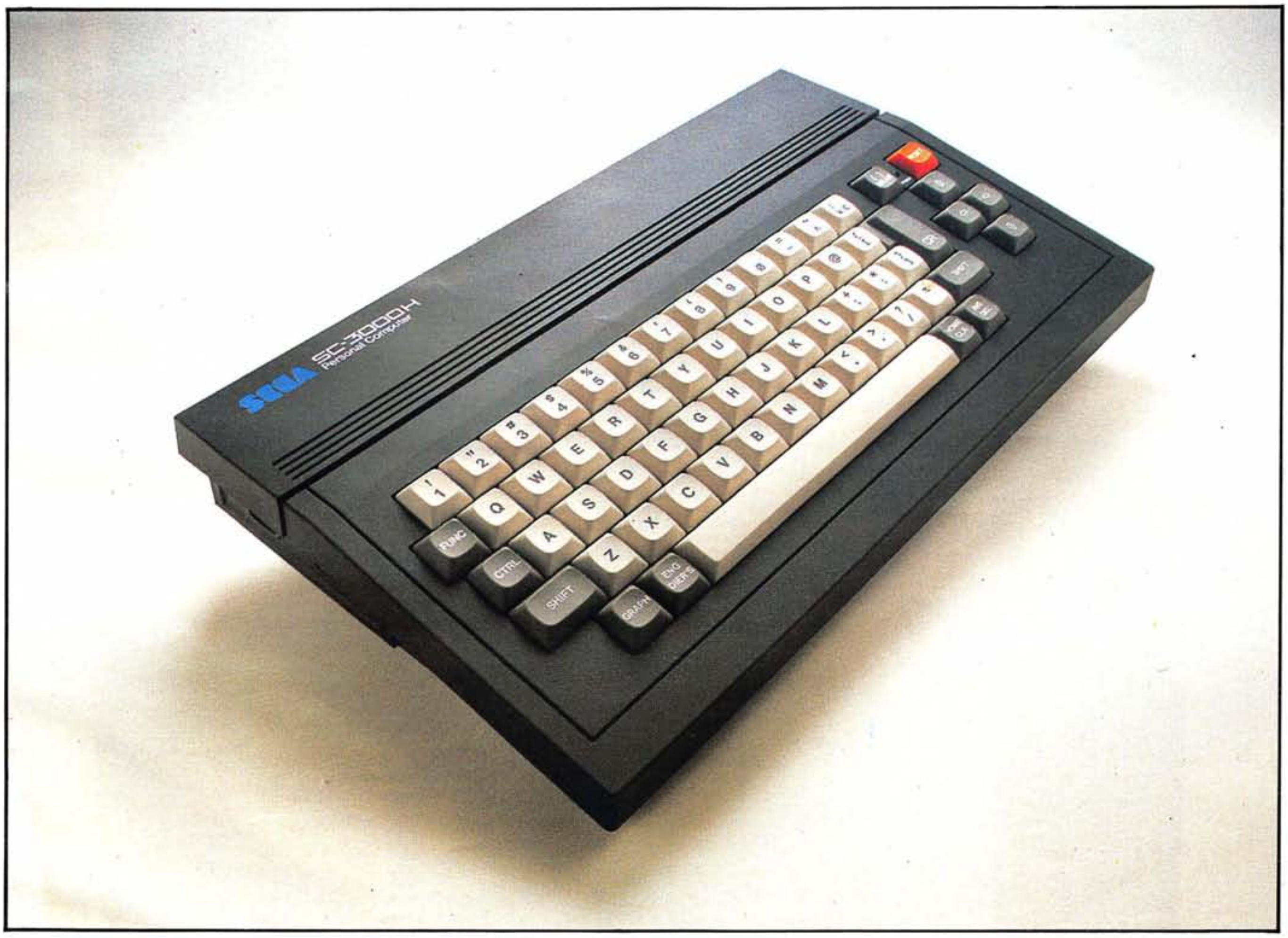
Sega SC-3000H

Peter Vernon assesses the latest home micro from the ace arcade manufacturer.



The Sega SC-3000H computer offers a lot for the price. Manufactured by the Japanese Sega company and distributed in this country by John Sands, one of Australia's largest publishers, the SC-3000H is loosely-based on the MSX standard. The system provides extensive colour graphics and sound effects capabilities, a powerful and easy-to-use Basic interpreter and a wealth of expansion possibilities and software in a compact, attractively styled console.

Packaged with manuals and a separate power supply pack in a sturdy cardboard carry-case, the SC-3000H provides everything you need to get started immediately. The console is low and sleek, and has 64 colour-coded keys in a standard typewriter configuration, The key action is light but positive, and the short range of movement of the keys makes typing very comfortable.

Cursor control keys for the SC-3000H are not clustered in the MSX style, but set on the left of the keyboard in a standard diamond layout, below the prominent red reset key. There are no programmable function keys, but on each side of the space bar are two extra keys including CODE and GRAPH and a key marked "dieresis", which sets the keyboard for operation in languages other than English (a dieresis is an accent mark over a vowel sound, as encountered in the French language).

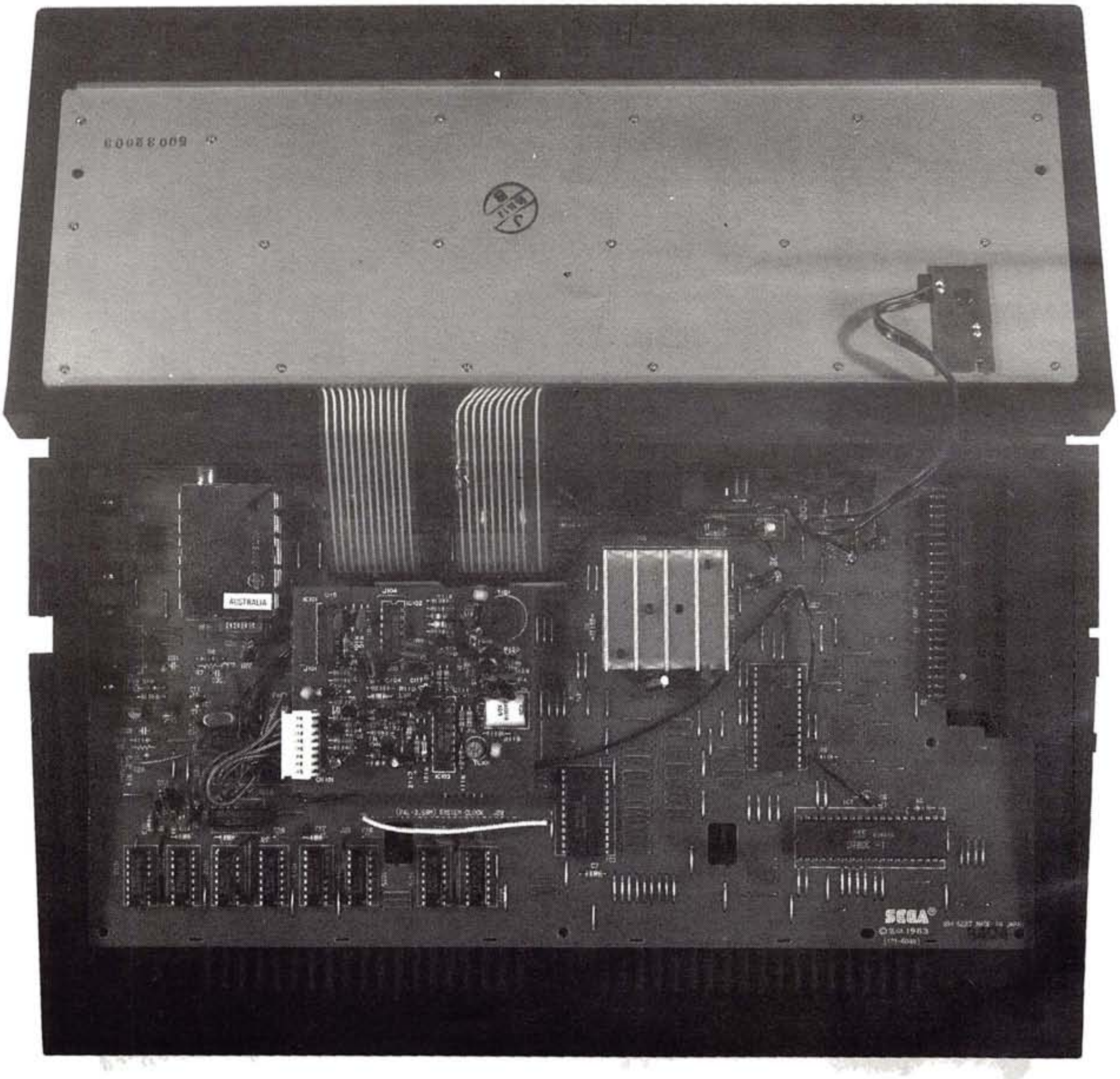
A set of silver paper stick-on labels is provided for the keyboard, and are intended to be mounted on the front of the keys to indicate graphics characters and the 48 Basic keywords available by pressing keys in conjunction with the CODE key. I have my doubts about the effectiveness of this approach. It wouldn't take long for the labels to come adrift and the overall effect is not likely to be attractive. Use of the labels is optional however, and by no means essential to the full enjoyment of the Sega computer.

Along the rear of the console are the power switch, five pin DIN plug for connection of a video monitor, a cassette port connection and an output for connection to a standard television receiver. A slot for software cartridges is at the right side. Power for the system is provided by a specially designed external plug-pack adapter.

Operation and Basic tutorial manuals are included with the computer, together with a cassette containing six educational programs and a "hands-on" programming tutorial. The manuals are comprehensive, but definitely take a "no frills" approach. I understand that John Sands is currently preparing a series of books on the SC-3000H which will be required reading for anyone wanting to make extensive use of the system.

On the other hand, it's good to see that the demonstration programs included with the system have been specially written for use in Australia. "General Knowledge" and "Geography Tutor" programs, for example, do not confront the user with questions on US or English subjects, and would be immediately useful in Australian schools. John Sands long experience in the Australian market shows to good advantage here.

Also provided is a cartridge containing



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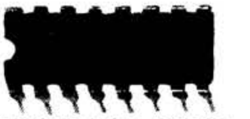

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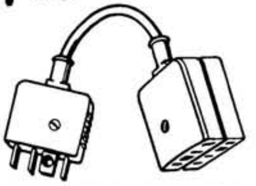

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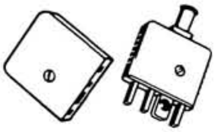

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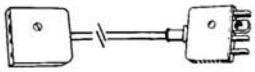

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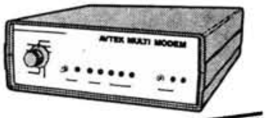

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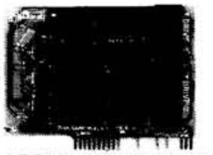

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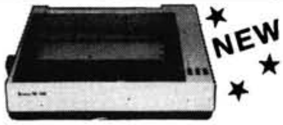

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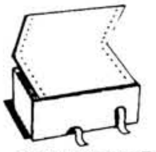

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Errors and Ommissions Excepted

Sega's Level 3 Basic interpreter in ROM. This cartridge (or another program cartridge) must be installed before you can use the computer.

In use

Connecting up the Sega SC-3000H is easy. Any standard cassette recorder can be used, although Sega also manufactures its own version specially designed for use with the SC-3000. A cable is provided to connect the modulated video output to a television receiver with output on VHF channel 3 or 4, and the colour display is clear and steady, with a large black border at the top and bottom of the display area to allow for the peculiarities of different television sets. Of course, a direct entry colour video monitor can also be used, by-passing the modulated video output to produce a sharper picture.

One minor short-coming is that the cassette port does not provide for remote control of the motor of the cassette recorder. If you are using tapes which contain more than one program you must be quick to stop the cassette recorder after a program has been loaded to avoid running the tape past the start of the next program. The absence of remote control is not uncommon in computers of this class however.

The SC-3000H is based on the Z80A processor, running at a clock speed of 3.58MHz. The standard system provides 32k of RAM and 32k of ROM, with an additional 16k of video memory, entirely separate from the main user memory. When not in use by the graphics controller, this memory can also be used to store program data, accessed by special versions of the PEEK and POKE statements.

The video display

When first switched on, the SC-3000 takes about five seconds to initialise the graphics controller circuitry and display the Basic sign-on message. This time is required because all aspects of the Sega's video display are controlled by software. The character set and display parameters must be copied from ROM into the video RAM of the controller to prepare the system for use, and this does take a noticeable amount of time. The corresponding reward, however, is a flexibility and versatility unmatched by other computers in this class.

The standard display format is 40 characters by 24 lines, in black on a green background. A 256 x 192 bit-mapped graphics mode is also available, in 16 colours, together with 32 sprites (graphics objects which can be created and moved independently of the remainder of the display). A 64 x 48 "chunky graphics" mode is also available with special programming, and of course, the character set is completely definable by software.

Although primarily a home computer, as indicated by the emphasis on graphics, sound and games programs, the SC-3000H should also find use in schools and as a low-cost entry system for small business applications.

These display facilities are provided by a remarkable display controller, the Texas Instruments 9929 VDP (for Video Display Processor), which is specified as standard for MSX machines. With its own 16k of memory, the VDP can provide four types of display operations (although only text and high resolution graphics are supported by the standard Basic). As mentioned, the text mode allows all 256 displayable characters to be defined by data stored in RAM, with the colour of each group of eight characters programmed by separate memory locations. The bit-mapped graphics mode is actually an extension of the text mode, but uses 768 definable character blocks to completely fill the screen with bit-mapped patterns.

The VDP also handles sprite display. Each sprite is a block of 16 x 16 pixels, and can be displayed with one of two settings for size and magnification. The position of each sprite on the screen is set by X and Y coordinates stored in the video RAM, so animation and special effects are easily achieved. Each sprite also has a priority which automatically determines which object will be visible if two or more sprites occupy the same location. Sprite 0, for example, is always displayed "on top of" sprite 1, which is on top of sprite 2, and so on up to sprite number 31. The sixteen colours available for sprites include a "transparent" colour, which allows the background, or another sprite, to be visible "beneath" the first. One of TI's favourite demonstration programs for the VDP shows a car with windows moving along a road. As the car moves, the changing background scenery is clearly visible through the windows. Imagine the effort that would be involved in programming such a display by normal pixel plotting! With the VDP it's all automatic.

Sound effects

Sound effects for the SC-3000H are provided by another Texas Instruments chip, the SN76496, rather than the General Instruments AY-3-8910 specified by the MSX standard. Both chips generate sound by dividing a basic clock frequency by various amounts to produce the desired tone, but the TI chip uses a 10-bit divisor rather than the 12 bits of the AY-3-8910. Theoretically the General Instruments chip is thus more accurate, but the difference is imperceptible except to the most discriminating ear.

Both chips provide the same capabilities — three independently programmable tone sources, a noise generator, a programmable mixer and a programmable amplifier with 16 volume settings. By mixing various sound sources, or "voices", or modulating the noise source with the output of one of the tone generators, a wide variety of special effects can be created, quite apart from standard musical notes and accompaniment for games. An internal speaker reproduces the sound effects.

Sega Level 3 Basic

All the features of the SC-3000H are well supported by Sega's own version of MSX-standard Basic. With the Basic cartridge in place the Sega reports 26,620 bytes free, out of the original 32k. The Basic stack and work area are responsible for the difference in the two figures.

The graphics commands of Sega Basic will be familiar to users of Microsoft Level 5 Basic, with the familiar LINE, PAINT, and CIRCLE statements. Parameters added to these statements allow boxes and ellipses to be drawn and set the colour of drawings from the 16 available. One new statement is BCIRCLE, which erases a previously drawn circle. The same effect can be achieved by drawing the circle again using the background colour.

Sprites are defined using the statement PATTERN followed by a string of hexadecimal characters, and are positioned on the screen with the SPRITE statement, which takes coordinates, colour and size settings as parameters. There's no mucking about with PEEK and POKE statements.

Other Basic statements control sound effects. Both SOUND and PLAY are available, the first requiring numeric values for frequency and duration and the second taking actual notes as arguments. A range of five octaves is supported.

Sega Basic does have a few restrictions which are absent in Microsoft versions however. No more than eight nesting levels are permitted for GOSUB statements, and no more than 16 nested FOR . . . NEXT loops. In practice these restrictions have no effect, as few programs would approach these limits, but the user should be aware of them in any case.

When first initialised Sega Basic sets aside just 300 bytes for the storage of character strings. Any program which requires more text handling capability must first clear additional memory for string storage space.

Software

A wide range of software is available for the SC-3000H on cassettes and in plug-in ROM cartridges. The largest part of this range is games, including the usual "shoot-em-up" space games and re-creations such as baseball, tennis, soccer and boxing. A number of adventure-type games is also available, including graphics adventure programs. All the games which I have seen make full use of Sega's graphics and sound effects and rival many arcade games, which is only to be expected considering the Sega company's long experience in this field.

Other application programs include a spreadsheet with 256 columns by 10,000 rows (subject to memory limitations), a fully-fledged word processor and some exceptionally good music programs. The music cartridge, in particular, allows you to compose and play music note by note or in phrases, and comes with an extensive "Music Editor" handbook and a keyboard overlay.

Due for release shortly is a database program and a version of the Logo language. A Z80 assembler, Basic tutorial program and further educational programs will also be available soon. Whether you are interested in games, educational applications or small business programs, the SC-3000H is likely to have something for you.

Expansion

Expansion for the SC-3000H is provided by the "Super Control Station", a metal box which connects to the console through a ribbon cable and plug-in cartridge pack. A single 3-inch disk drive is included which provides 156k bytes of storage space per disk, together with RS-232C serial and Centronics-type parallel interfaces and additional RAM to bring the total programmable memory up to 80k (including the 16k video RAM). The expansion unit comes with a disk version of Basic to add the extra commands required to save and load programs on disk, access data and keep disk directories in order.

Other accessories include the cassette recorder already mentioned, a joystick unit and a four colour printer/plotter which uses tiny pens to "draw" characters and graphics shapes on 10cm wide paper.

Conclusion

The SC-3000H is the latest version of the Sega computer, which was originally supplied with 16k of memory and a less extensive version of Basic. Considering the capabilities of the system, the range of available software and the marketing support facilities made available through John Sands, the new system is particularly good value. Although primarily a home computer, as indicated by the emphasis on graphics, sound and games programs, the SC-3000H should also find use in schools and as a low-cost entry system for small business applications. In the under $500 class, there are few computers which can match the capabilities of the SC-3000H.

Prices

The basic console described here is priced at $349 including tax. The Sega cassette recorder is an additional $99 and a joystick unit is $19.95. Programs on cassette also cost $19.95, and software cartridges are $39.95. The price of the expansion unit is $799, including disk Basic and the additional memory.

A number of retail outlets stock the SC-3000H and can supply further information. John Sands Electronics is at 6 Bay Street, Port Melbourne, Victoria 3207, or in New South Wales, at the corner of Allambie and Warringah Roads, Frenchs Forest. There are also offices in Brisbane, Perth and Adelaide.

Technical specifications

CPU:	Z80A processor running at 3.58 MHz
ROM:	32k
RAM:	32k plus 16k video RAM
Keyboard:	64-key typewriter standard
Display:	Text mode 40 x 24, graphics 256 x 192, 16 colours, 32 programmable sprites
Sound:	Three channels plus noise source, five octaves
Interfaces:	Direct video, RF modulated video, cassette port

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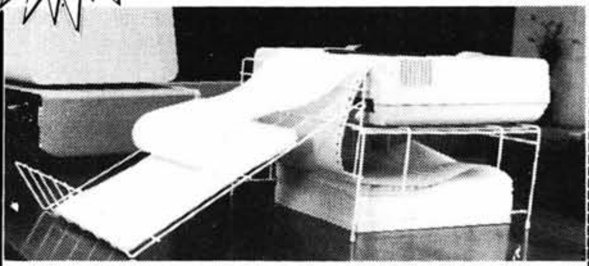

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Acornsoft's Viewsheet

Serious applications for home micros are still few and far between. Viewsheet from Acornsoft is a straightforward but powerful spreadsheet which transforms the BBC Micro into a simple business machine. Mike Liardet figures it out

The difference between home and business computers is ever decreasing as the prices of business systems fall and home computers become more sophisticated. Similarly the gap between home and business computer software is closing and there is now a trickle of very sophisticated home computer software products. One such product is Viewsheet.

Viewsheet is a spreadsheet system for the BBC Micro. Although of prime interest to serious home users, it is also worthy of any business application. It has a blindingly fast calculation speed, an advanced multiple windows facility, and the ability to link multiple models. It is one of a range of products from Acornsoft, including database and word processing, designed to intercommunicate.

Installation

Viewsheet is sold in a compact little box containing a manual, reference card and a keynote template. The software itself lies in a 16k ROM chip, protected by an electrostatic-proof sponge mat. This ROM chip must be housed in one of the BBC's 'sideways ROM' sockets — of which the BBC Micro has five specifically for optical software such as Viewsheet. Once installed, the chip can stay there indefinitely (unless you plan to run more than five ROM products), which is just as well, as it is not designed for repeated insertions and extractions.

The benefit of software in ROM is that it is available as soon as the computer is switched on, and none of the internal RAM is taken up with software. On the other hand ROM chips cost more than cassette tapes, which unfortunately pushes up the price of the product. There is also the problem of installing the chip: this is dealt with by an accopmpanying leaflet containing full instructions.

If you are not technically minded the idea of inserting chips into the guts of your precious computer may seem a little intimidating. But the instructions are quite explicit, and a screwdriver is the only tool necessary. There's no soldering — the chip is simply pressed into a waiting socket (a process which takes no more than five minutes, including the time spent reading the instructions).

My only difficulty with installation was caused by the identifying label on the top of the chip. It is vital that the chip is placed the right way round, and the leaflet explains that a notch on top of the chip indicates its correct position. In my case the label obscured the notch, but peeling it back revealed all, and one careful push had it in place.

Getting started

When the BBC is switched on, whichever chip is in the rightmost of the five sideways ROM sockets is given control. If it's Viewsheet, then Viewsheet is automatically started; but whichever chip is activated, it will be in a state known as 'command mode'. This is where a variety of commands can be typed in at the keyboard, and the application itself is not on display.

Most ROM-based packages for the BBC support a common core of commands, relevant to all applications; for example, NEW clears out memory, erasing an existing spreadsheet for Viewsheet, or word processor text for View. There are special disk commands (if you have disks), and commands like LOAD, SAVE and PRINT have predictable effects, depending on the host application. It is possible to switch applications in command mode by typing '*' followed by the application name: if Viewsheet is not in the rightmost socket, it can be activated following switch-on, by typing '*SHEET'.

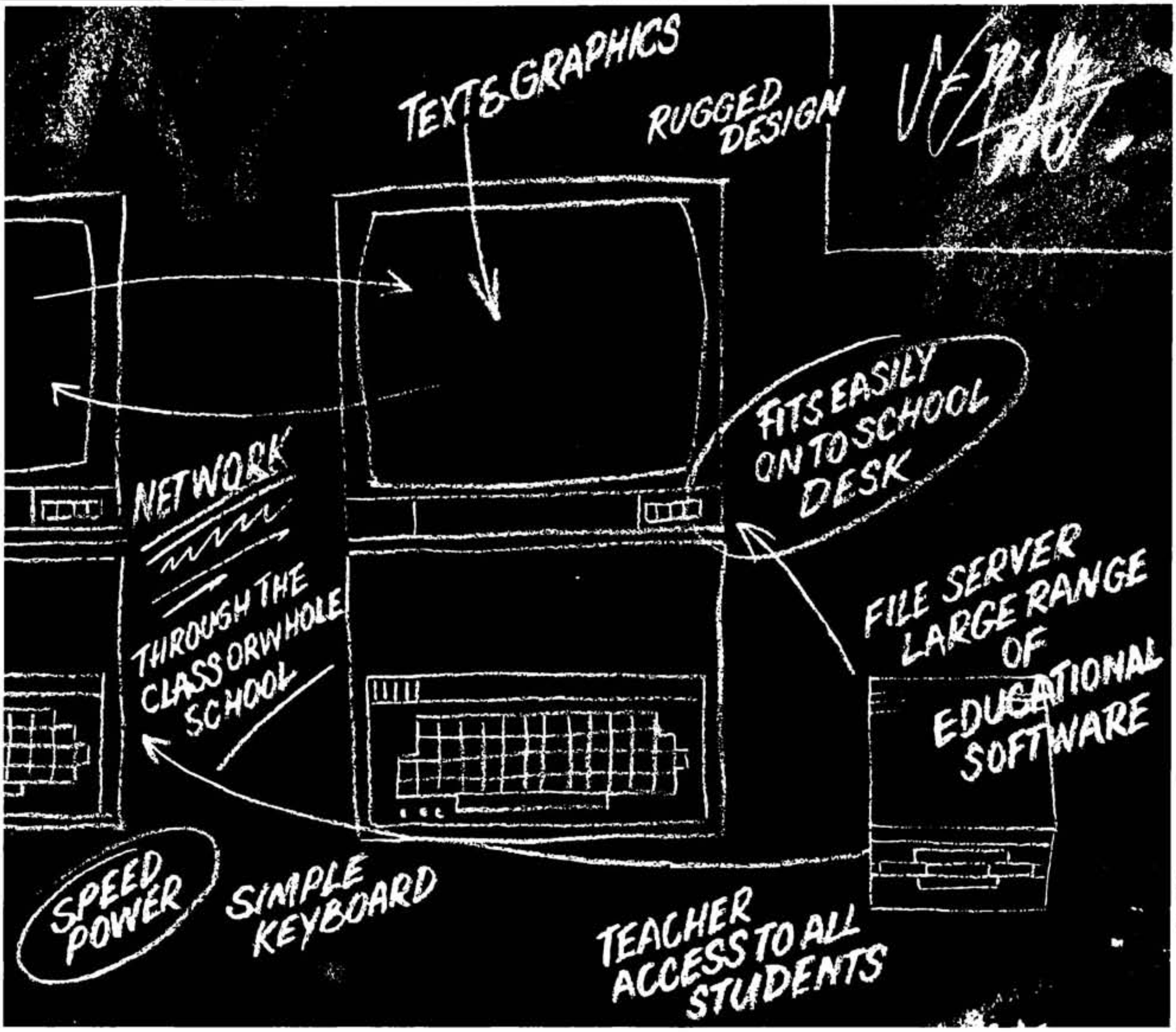
As soon as Viewsheet has been activated, spreadsheeting can begin by pressing the ESCAPE key. This key toggles between command mode and application mode, and in the case of Viewsheet the application mode results in a fairly orthodox display of the first 19 rows and first few columns of an empty spreadsheet. The number of columns visible depends on the currently selected 'display mode'.

The BBC Micro offers eight different display modes, numbered 0 to 7. The possibilities include high-resolution graphics, or colour, or 80 or 40 characters per line. Viewsheet can operate with any of these, or even cope with changes in mid-session, but the best display is obtained with number 3 which has 80-characters per line and optional inverse characters. Unfortunately, this also consumes a lot of free memory, which could be better used by the spreadsheet model. Nevertheless, it is best to start with this, and opt for a poorer display mode later if memory gets tight. In command mode, the type of display can be changed using the MODE command — thus MODE 3 switches the display image to smaller characters so that 80 can fit on a line. Following this, the ESCAPE key switches the display back to the spreadsheet.

Basic facilities

When spreadsheeting, the first four rows of the screen contain status information or echo text typed in at the keyboard; the rest of the screen displays the spreadsheet itself. Initially most of the area is blank until something is entered into the spreadsheet. The left-hand side is earmarked for row numbers, and the top of it for column identifiers: A, B, C and so on. In display mode 3, nine 8-character columns can be accommodated.

For basic spreadsheeting, Acornsoft has introduced few innovations in Viewsheet. The familiar cursor hovers over one of the cells, and can be moved up, down, left or right by pushing one of the arrow keys at the right of the keyboard. The screen window can be shifted to a new portion of the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spreadsheet by directing the cursor there. The spreadsheet extends to 255 rows and 255 columns in all. As on most 8-bit computers there is insufficient memory to use all 65,000 cells available (see Benchmarks box).

Text numbers and formulae can be entered into the spreadsheet by moving the cursor to the required cell, and then typing in whatever is required. Viewsheet sorts this out, and automatically recalculates following any modifications.

Formulae are built up using the normal spreadsheet conventions, with '*' = 'times', '/' = divide and cell references like A1 or BK23 being permitted. Viewsheet also employs 'operator precedences', which reduce the need for parentheses. For example:
A1 * B2 – C3 * D4
is calculated as:
(A1 * B2 – (C3 * C4)
since '*' has a higher precedence than '–'.

A variety of built-in functions are provided, including trigonometry, logic and exponentiation. There are also a number of spreadsheet 'specials': for example, AVERAGE can be given a list of values or cell references and will calculate the average of them:
AVERAGE (23, A1-1, B2D3)
will calculate the average of 23, the contents of cell A1 less 1, and the six cells in the rectangle from B2 to D3. Another special function is CHOOSE:
CHOOSE (D1, 31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31) would evaluate to the number of days in the month number stored in D1. An interesting omission is the SUM function, for summing a row, column or area. Viewsheet has a special notation for summing:
A1A12
sums the 12 values from A1 to A12, using neat and concise notation.

Viewsheet provides a good range of spreadsheet editing facilities, such as row or column insertion and deletion, and replication, and so on. It is also possible to edit a cell contents, saving the need to retype from scratch following an erroneous entry. All these facilities are activated by pressing one of the function keys.

The BBC is equipped with 10 function keys at the top of the keyboard which are coloured in a contrasting red. The use of these keys is explained in the manual but, as a source of quick reference for the expert, Viewsheet is supplied with a keyboard template which can be fitted just above the keys. This merely summarises the function of each. The function keys can also be pressed in conjunction with the control or shift keys, allowing for up to 30 functions in total. The template is arranged in three rows, to cover all thirty possibilities. Only seven entries are blank, so 23 of the 30 possibilities are used by Viewsheet.

Windows

In addition to conventional basic spreadsheet editing facilities, Viewsheet offers some advanced features. In particular, it is possible to define multiple windows. Multiple windows are useful when it is necessary to view distant parts of the spreadsheet simultaneously. The best example of this is in budgeting, when the profit line at the bottom of the spreadsheet is always of interest, even when entries right at the top are being changed. But there are many other situations when windows are useful.

Viewsheet provides for up to 10 windows onto the spreadsheet, nine of which are inactive, while one is defined to occupy the entire screen. This is, of course, a rather limited use of Viewsheet's windowing capability, but appears to the user as a perfectly normal spreadsheet, as described above. In fact, there is no need to know about windowing in the initial stages of using Viewsheet.

The 10 windows are numbered 0 to 9, and to initiate a non-trivial usage it is first necessary to shrink the one active window, otherwise there is no room for anything else. The sole active window, number 0, can be changed by pressing the 'edit window' function key, and specifying that window 0 is to be altered. Each window has a number of attributes which 'edit window' can change: to reduce it in size, alter the style of display, or the way it works.

Two of the attributes specify the top left and bottom right cells to be displayed. For window 0 these are set to A1 and 119 by default. The specification of A1 and 119 determines the initial window display, a rectangle of cells with A1 at the top left and 119 at the bottom right, but these values do not prevent the window from displaying other parts of the spreadsheet. Normal cursor moves have the usual scrolling effect within the window; thus the two cell references are more significant for the size of window implied, that is, 19 rows by nine columns. Changing 119 to B5, say, shrinks window 0 to just 10 cells, leaving plenty of room for other windows below it and to the right.

A new window can be activated by using 'edit window', but for a different window number, and as before the top left and bottom right can be specified. It is possible for the window to focus just on a single cell, when top left and bottom right are the same. Another attribute is the display position of the window, which must be either beneath or to the right of a previously defined window. In addition, windows can have different column widths as well as different numeric display format, numbers of decimal places and left or right justification.

Each window has an 'Options' attribute and initially, for all bar window 0, the window-off option is in force. Thus to activate a window this must be turned on. But it can be turned on in various ways: row and column identifiers can be visible or not, and there is a primitive graph option (which displays numbers as asterisks in order to produce horizontal bar graphs), or the window can be synchronised to other windows.

Synchronisation can be useful if, say, two single column windows are aligned vertically on the screen, showing different parts of a month's data. With synchronisation a cursor move to a new month in one window will automatically change the other window to the same month.

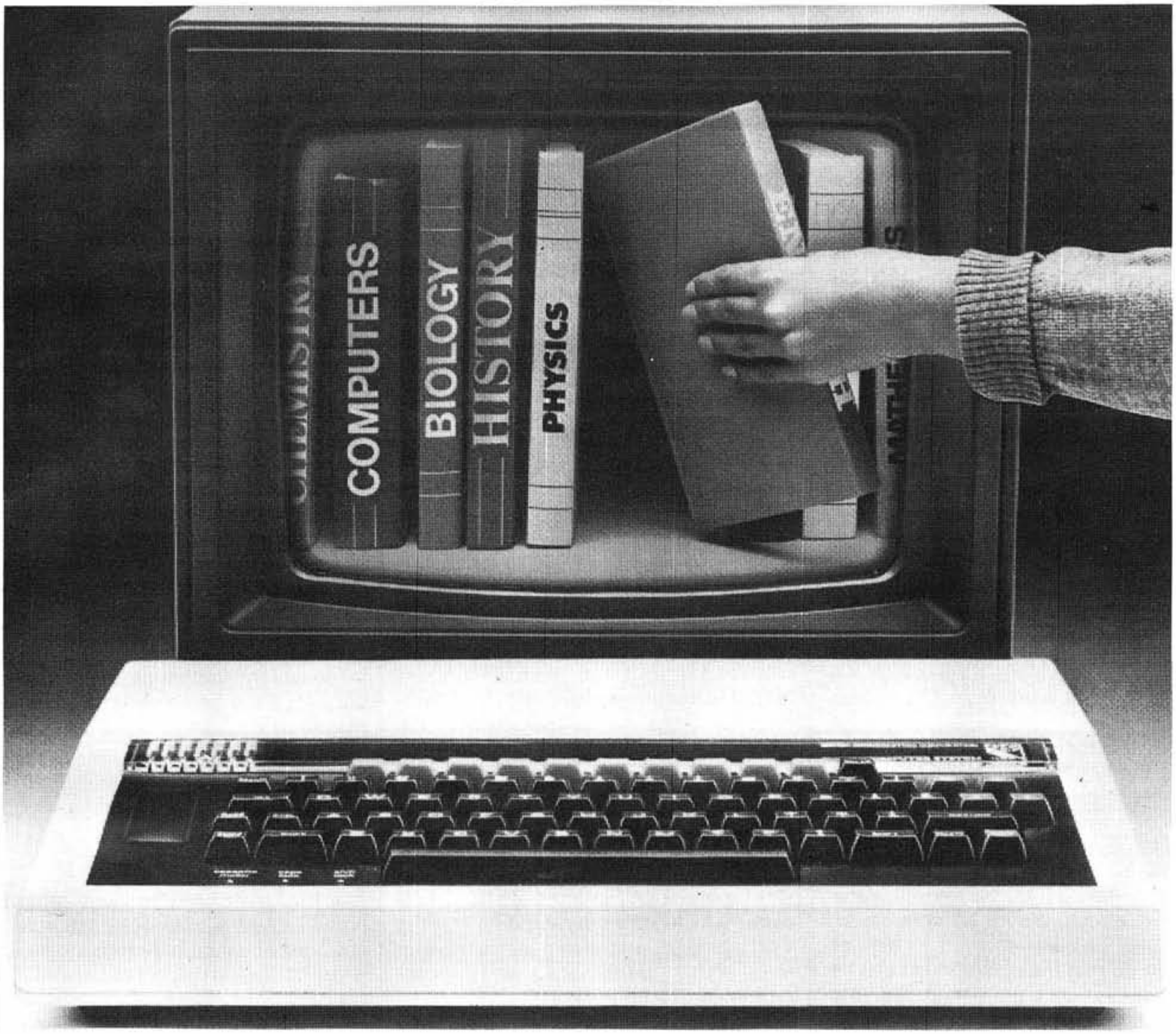
When several windows are on screen simultaneously, only one cursor is present, in one window. Although the window is smaller than the single original window, it operates in an identical fashion, except that other windows may be synchronised to it. To move the cursor to a new window requires the 'next window' keystroke. One of the function keys is used for this.

Although sophisticated displays can be arranged, they may require some thought and planning. Fortunately, Viewsheet allows window definitions to be loaded and saved independently; this means that a complex window arrangement can be reused with several spreadsheet models.

Finally, should the window definitions be in error, and require more screen display than is actually available, then the excess is automatically clipped from the display. This situation can also arise if the display mode is changed to fewer characters per line. Unfortunately, it is not a rarity for an inferior display mode to be needed. The BBC model B has 32k of RAM, but the spreadsheet data must share this with the data for the display itself. The best display mode (MODE 3) leaves only 9k for the spreadsheet data. The least attractive display mode (MODE 7), with only 40 characters to a line, leaves all of 24k for the spreadsheet data. (The Benchmark performance tests were done with both modes.)

Advanced facilities

There are a number of advanced spreadsheeting features in Viewsheet,



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which I shall touch upon lightly.

Initially the rows of the spreadsheet are numbered, and the columns are identified by letters, but Viewsheet allows these to be changed selectively. Thus more meaningful row headings can be used: for example, row 10 might be renamed as 'SALES', and columns A to L as 'JAN' to 'DEC'. These new headings can be used in cell references – 'JAN' 29 instead of A29 or 'FEB SALES' instead of B10.

It is possible to protect individual rows or columns, but not single cells, against accidental deletion or changes. This is useful for setting up turnkey applications, where an unskilled user can be prevented from inadvertently destroying part of the model.

Printouts from Viewsheets are, like the display, handled by a window facility. In addition to the 10 display windows there are 10 printer windows, which are specified in the same fashion as above. On specifying the PRINT command, all the active windows are printed with the required formats. A printout can be made to mirror the screen display, although normally it is more useful to take advantage of the larger dimensions of printer stationery to print out the full width and length of a model. But there is a great deal of flexibility, and different style printouts can be quickly obtained by switching the various printer windows on and off before issuing the PRINT command.

It is also possible to print to disk or cassette, so that the spreadsheet can be subsequently read as a text file into Acornsoft's word processor, View. Like printing to paper, this facility makes full use of the printer windows.

If you have disk drives, then Viewsheet's workspace is not just limited to the non-display RAM in the BBC, but it's possible to use up to five auxiliary arrays of numbers, on disk. Each array can have up to 255 rows and columns, with a maximum of 10,710 elements in all. For five arrays, this means spreadsheet models can contain over 50,000 numbers in total. Any element in any array can be read or written automatically during spreadsheet recalculation. Apart from greatly expanding the capacity of the system, this feature also enables consolidation operations to be performed. Each array could contain the figures for different departments in an organisation and a simple read then sum loop can consolidate all the data into a spreadsheet. Of course, disk access can slow down calculations, but the manual contains hints for optimising this, and the facility enables tasks to be performed that would not normally be feasible on an 8-bit micro.

> *'Viewsheet offers some advanced features . . . multiple windows are useful when it is necessary to view distant parts of the spreadsheet simultaneously.'*

Documentation

Viewsheet is supplied with a paper-back-size, spiral-bound manual of about 140 pages which comes in two parts, starting with a tutorial, and then a reference section. Both parts are well cross-referenced by an index.

The tutorial section is very clear, and contains a number of screen illustrations. It assumes no prior knowledge of the BBC Micro. Not unreasonably, it does not describe how to set up the BBC hardware, but apart from that it is completely self-contained. From the operational point of view there is no need to refer to any of the BBC manuals in order to use it.

The reference section gives a brief rundown for every aspect of Viewsheet, including details of all the available commands (in command mode), function keystrokes, and so on.

The remaining documentation comprises a reference card, the chip installation instructions and the keyboard template. Both the keyboard template and the reference card are invaluable as a quick guide when you become familiar with the system. If you are continually switching between several packages, each with its own template, it is a little inconvenient to change them: the template is held in place under a transparent plastic strip which must be sprung open to replace a template making it difficult to get the new one correctly aligned with the function keys.

Conclusion

The BBC Micro can be used either as a home or as a simple business machine, and Viewsheet complements it nicely: it is very simple to use but it is also very fast and powerful.

Having the software in ROM circumvents the usual home computer problems of slow tape loading. The software is also compatible with the BBC disk drives.

My only major reservation about Viewsheet is the limited RAM storage capacity of the BBC Micro, which restricts the size of spreadsheet models. Viewsheet mitigates this by permitting auxiliary data storage on the disks, but the use of an auxiliary RAM board would also be of help.

Viewsheet retails for $153.

Benchmarks

These tests were performed on a BBC Model B computer with 32k of RAM. The spreadsheet capacity is greatly affected by the display mode used, so the tests were performed for the two most common modes: 3 and 7. In mode 3 9,486 bytes are available for spreadsheet storage, and in mode 7 24,846 bytes are available. Where different, the mode 3 figures are given in parentheses.

Maximum number of columns: 256
Maximum number of rows: 256 (plus up to another 53,550 cells on disk)
Numeric precision: 10 digits
Maximum column width: 31 (71) characters

1 (a) Maximum rows accommodated: 72 (27)
  (b) Recalculation time: 10 (4) seconds — that is, 7.2 rows per second
  (c) Horizontal scrolling: 1.6 columns per second
  (d) Vertical scrolling: 1.8 rows per second
  (e) Time taken to load/save 72 row model on cassette: 45 seconds — that is, 1.6 rows per second
2 Number of rows of text accommodated: 170 (65)
3 Number of rows of numbers accommodated: 104 (39)

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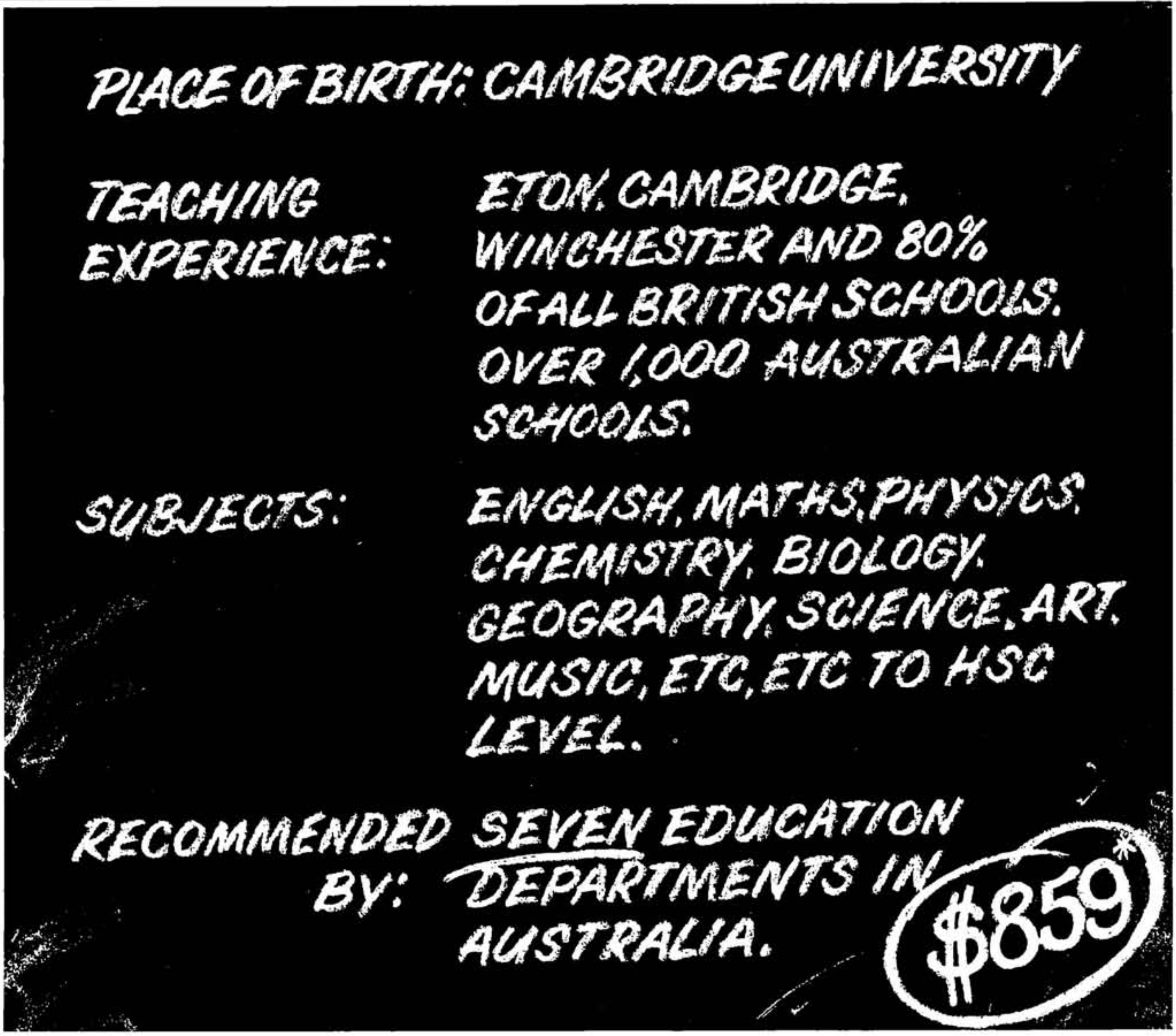
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TJ'S WORKSHOP

Our monthly pot-pourri of hardware and software tips for popular micros. If you have a favourite tip to pass on, send it to 'TJ's Workshop', 77 Glenhuntly Road, Elwood, Victoria 3184. Please keep your contributions as concise as possible. APC can accept no responsibility for any damage caused by using these tips, and readers should be advised that hardware modifications may render the maker's guarantee invalid.

COMMODORE 64 MACHINE CODE AUTO-START

I am interested in running my own machine code programs on the Commodore 64, but I need some way to get them to auto-start when loading from tape. Using a Basic program to load them is one option, but since that uses extra memory space, it isn't very helpful.

Basic programs can be automatically started when loaded using SHIFT/RUN, so I decided to make my machine code program look like a Basic program and the result is shown here.

The number in single quotes is the start address (which can be as low as 2074, as in the example). A five-figure start address can be obtained by replacing the leading space with the extra digit.

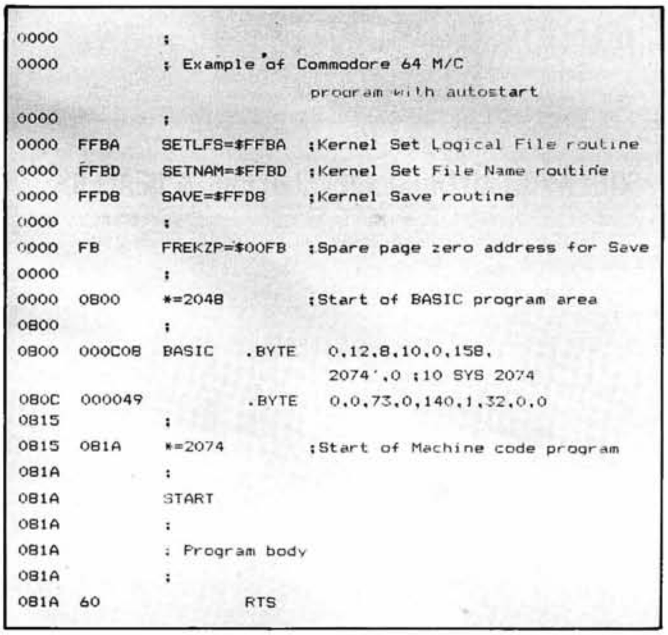
To save the program on tape initially, start the program at SAVEIT and the usual SAVE messages will appear (verification is also possible). Note that only memory from 2048 to PROGTOP is saved. When loaded by SHIFT/RUN, the program will load and start with the first Basic line, which is a call to the machine code routine at 2074. The main body of the program is executed and a return (via the RTS) is made to the line following the SYS statement, which returns to the Basic monitor.

When LISTed, the program appears as follows:

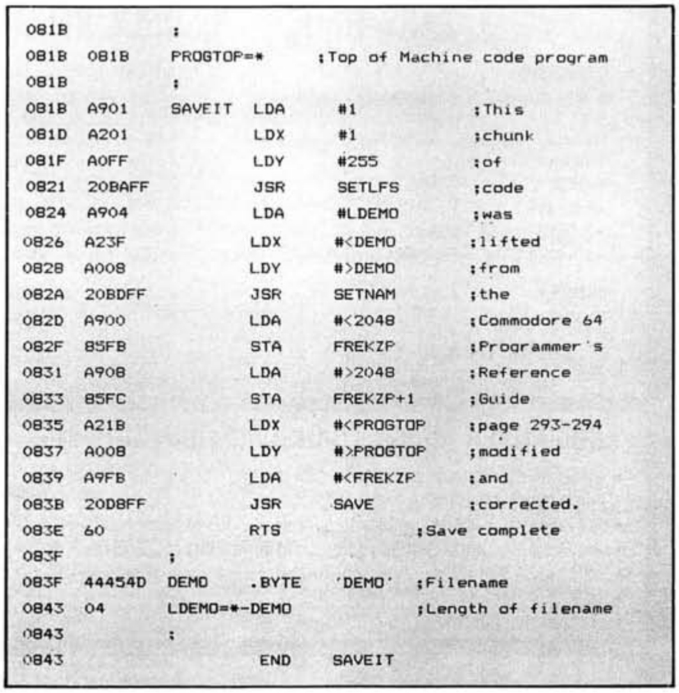
10 SYS 2074

Also, as with Basic, the machine code program can be re-run at any time by typing RUN.

W Turner



```
0000             ;
0000             ; Example of Commodore 64 M/C
                                  program with autostart
0000             ;
0000  FFBA       SETLFS=$FFBA  ;Kernel Set Logical File routine
0000  FFBD       SETNAM=$FFBD  ;Kernel Set File Name routine
0000  FFD8       SAVE=$FFD8    ;Kernel Save routine
0000             ;
0000  FB         FREKZP=$00FB  ;Spare page zero address for Save
0000             ;
0000  0800       *=2048        ;Start of BASIC program area
0800             ;
0800  000C08     BASIC   .BYTE  0,12,8,10,0,158,
                                2074',0 ;10 SYS 2074
080C  000049             .BYTE  0,0,73,0,140,1,32,0,0
0815             ;
0815  081A       *=2074        ;Start of Machine code program
081A             ;
081A             START
081A             ;
081A             ; Program body
081A             ;
081A  60                 RTS
```



```
081B             ;
081B  081B       PROGTOP=*        ;Top of Machine code program
081B             ;
081B  A901       SAVEIT  LDA    #1           ;This
081D  A201               LDX    #1           ;chunk
081F  A0FF               LDY    #255         ;of
0821  20BAFF             JSR    SETLFS       ;code
0824  A904               LDA    #LDEMO       ;was
0826  A23F               LDX    #<DEMO       ;lifted
0828  A008               LDY    #>DEMO       ;from
082A  20BDFF             JSR    SETNAM       ;the
082D  A900               LDA    #<2048       ;Commodore 64
082F  85FB               STA    FREKZP       ;Programmer's
0831  A908               LDA    #>2048       ;Reference
0833  85FC               STA    FREKZP+1     ;Guide
0835  A21B               LDX    #<PROGTOP    ;page 293-294
0837  A008               LDY    #>PROGTOP    ;modified
0839  A9FB               LDA    #<FREKZP     ;and
083B  20D8FF             JSR    SAVE         ;corrected.
083E  60                 RTS             ;Save complete
083F             ;
083F  44454D     DEMO    .BYTE  'DEMO'   ;Filename
0843  04         LDEMO=*-DEMO            ;Length of filename
0843             ;
0843                     END    SAVEIT
```

ATARI OUTPUT DEVICE

This subroutine allows you to change the Atari's standard output device (the standard output is where all system messages, PRINT statements, and so on appear, and normally this is the screen). With this subroutine, you can specify another device (usually a printer) and save yourself the bother of writing everything twice using PRINT &LPRINT. The routine will work regardless of operating system, or even if you have superseded the normal device driver by adding a new device handler.

Simply type STDOUT$ = "P:" or STDOUT$ = "E:" (depending on whether you want printer or screen output), then GOSUB 10000. Everything will be then sent to the chosen device.

```
   10 DIM STDOUT$ (2):
      REM DECLARE THE
      STRING FOR USE
      THROUGHOUT THE
      MAIN PROGRAM
      AND IN THE
      SUBROUTINE
      ITSELF
```

Main program

```
10000 FOR DEVICE = 830
      TO 794 STEP -3:
      IF PEEK (DEVICE)
      = ASC (STDOUT$)
      THEN HANDLER =
      PEEK (DEVICE + 1)
      + 256* (PEEK
      (DEVICE + 2)):
      POP: GOTO 10020
10010 NEXT DEVICE:
      PRINT "NO SUCH
      DEVICE": RETURN
10020 POKE 838, PEEK
      (HANDLER + 6):
      POKE 839, PEEK
      (HANDLER + 7):
      RETURN
```

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(For details see left)

BBC MODE CHANGE

Here's a short program which enables you to change MODE on the BBC Micro with OS 1.20 without clearing the screen.

At first sight, all that's needed is to set up the correct parameters in the 6845 CRC controller and, although this will change MODE, the operating system has not been notified of the change, so some of the system variables will be incorrect.

Disassembly of the OS 1.20 ROM reveals that the MODE change routine starts at &CB1D. At &CBF0 the screen clear routine seems to be entered, which is not required.

The short program shown transfers the code between &CB1D and &CBF0 to &2000 onwards. An 'RTS' instruction (opcode &60) is then inserted at location &20D3 so that the screen clear routine is not entered.

The rest of the program is an infinite loop which allows you to select the MODE you want to be in by pressing the appropriate number key. The MODE change routine is entered with the new MODE number in the accumulator; this is set by the value of A% in line 60.

The program is best run when the screen contains a lot of writing, as the effect when changing MODE is better.

```
10  FOR X = 0 TO &D3
20  X?&2000 = X?&CB1D
30  NEXT
40  ?&20D3 = &60
50  REPEAT
60  A% = GET - 48
70  CALL &2000
80  UNTIL FALSE
```

R Turner

SPECTRUM ERROR ROUTINE

This routine, for either Spectrum, enables you to disable the BREAK key and provides various options for other errors.

The routine must be activated initially, or, if continuing after a break for an error, with RAND USR onerror. This will replace the contents of the address on the stack pointed to by ERR SP with an address in this routine, so that it will be called whenever the Basic interpreter finds an error.

You can set any of five modes, by POKEing errmode.
Mode 1 — report all errors normally.
Modes 2 to 5 — disable BREAK key, report OUT OF MEMORY; and for all other errors:
Mode 2 — report normally
Mode 3 — GOTO next line.
Mode 4 — GOTO 9990.
Mode 5 — clear program before reporting error.

Mode 3 is for anticipated errors.
Mode 4 is for unexpected errors. There's a choice of exiting or returning to the main menu.
Mode 5 enables you to load a Basic program and leave nothing to list after a loading error.

After an error, PEEK errnumb will return the error number, and the line and statement numbers where the error occurred will be in OLDPCC and OSPCC. The routine RASPs before reporting an error and is relocatable.

Rosemary Oakeshott

```
9000 REM error routine
9002 REM
9004 CLEAR PEEK 23730+256*PEEK 2
3731-135: REM lower ramtop
9006 LET onerror=PEEK 23730+256*
PEEK 23731+1
9008 LET errmode=onerror+28: LET
 errnumb=onerror+27
9010 FOR i=onerror TO onerror+13
4: READ a: POKE i,a: NEXT i
9012 REM
9014 REM
9016 DATA 33,16,0,9,235,42,61,92
,115,35,114,237,75,118,92,201
9018 DATA 58,58,92,60,40,110,205
,198,31,24,2,0,1
9020 DATA 35,35,119,35,86,1,244,
255,9,229,21,40,78,254,21,40,51,
21,40,71
9022 DATA 42,69,92,34,110,92,35,
21,40,6,33,9990-256*INT (9990/25
6),INT (9990/256),21,32,38
9024 DATA 254,4,40,51-0*14: REM
1*14 will clear program before r
eporting no room
9026 DATA 205,115,30,58,71,92,50
,112,92,253,203,1,254,33,0,0,253
,116,38,253,116,55,34,11,92,205,
176,22,253,112,0,195,125,27
9028 DATA 21,32,14,237,91,83,92,
42,89,92,43,205,229,25,34,75,92
9030 DATA 22,0,253,94,254,33,144
,26,205,181,3,225,195,3,19
9032 REM
9034 REM Activate Error Routine
9036 REM
9038 LET errdef=2: REM or what y
ou will
9040 POKE errmode,errdef: REM un
necessary if errdef=1
9042 RANDOMIZE USR onerror
Example of mode 3.
------------------
  40 REM to input b in range 1 t
o 10
  50 POKE errmode, 3: REM on err
or goto next line
  60 INPUT b: IF b>=1 AND b<=10
THEN  GO TO 80
  70 BEEP .5,-8: GO TO 60: REM O
ut of range, Stop in input,divid
ing by 0 or other error.
  80 POKE errmode,errdef
  90 REM
```

ATARI FEATURES

Here are some useful features for any Atari machine.

A POKE 559,0 will turn off the screen display. Why should anyone want to do this? To make the program being executed perform 30 per cent faster. A POKE 559,34 restores the display to normal.

Another use for this technique is when the programmer wants an image to appear instantly without the user witnessing the image being drawn.

A PEEK into location 764 provides Atari Basic with a simple INKEY$ function; the value returned is an internal code representing the last key pressed. The location can be reset by a POKE 764,255.

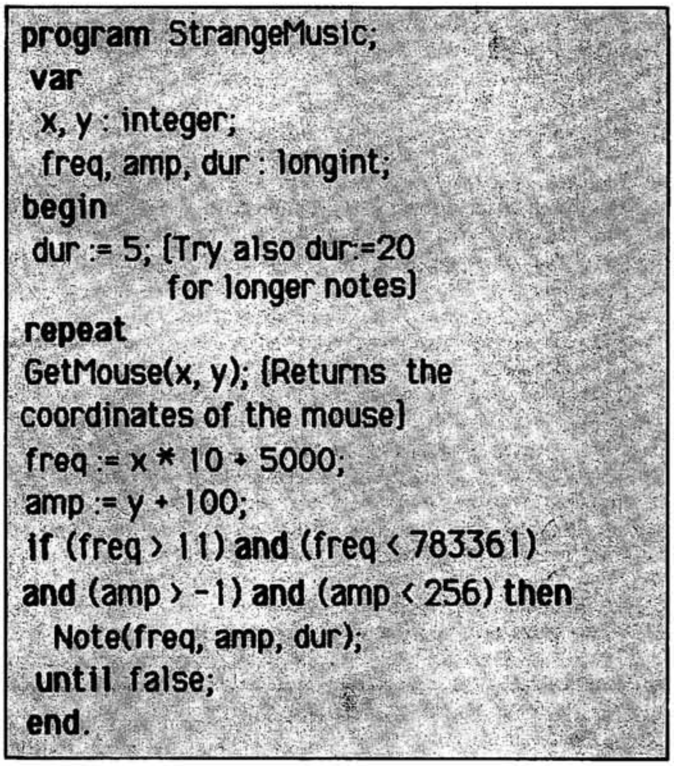
J Owen

MACTIP

The following short program demonstrates the interactive use of the Macintosh mouse. The procedure GetMouse(x,y) returns in x and y the horizontal and vertical coordinates respectively of the current position of the mouse at the time GetMouse is called.

The Macintosh has fairly sophisticated facilities for sound production, including a "free-form synthesizer" for making complex music and speech. The procedure used here is the simplest of the lot. Note(Frequency, Amplitude, Duration) causes a single square wave tone to be generated. The 'if' statement ensures that the parameters are within their allowed ranges.

Despite (or perhaps because of) the simplicity of the program, the sounds which it generates have a strange quality to them, especially if the mouse is moved about rapidly. The program repeatedly cycles through the loop. Each time playing a note of duration dur. The horizontal position of the mouse determines the frequency, while the vertical position controls volume. The values of x and y given by the mouse's position are scaled to give useful magnitudes. These scaling factors may be changed to give a new range of sounds.



```
program StrangeMusic;
 var
  x, y : integer;
  freq, amp, dur : longint;
begin
 dur := 5; {Try also dur:=20
           for longer notes}
repeat
GetMouse(x, y); {Returns  the
coordinates of the mouse}
freq := x * 10 + 5000;
amp := y + 100;
if (freq > 11) and (freq < 783361)
and (amp > -1) and (amp < 256) then
  Note(freq, amp, dur);
 until false;
end.
```

VIC-20 RESET SWITCH

Have you ever tried an unusual POKE when typing in a program and found you've crashed the system? If you have and you own a VIC-20, then a 'reset switch' may be the answer to your problem.

You will need the following parts and a soldering iron:

(1) A simple push switch (circuit closed when depressed, circuit open when not).
(2) Some general purpose solder.
(3) A 0.156in 2x12 way edge connector MS No BK74R.
(4) Some extra flexible insulated wire (fine gauge).
(5) A sticky label.

The reset switch will be connected to the VIC-20 user port (left of tape port looking from keyboard side).

Now perform the following operations:

(1) Cut two lengths of wire, each approx 25cm long.
(2) Look at the edge connector with (gold) pins facing you.

Label the top of the connector 'UP' with your sticky label.

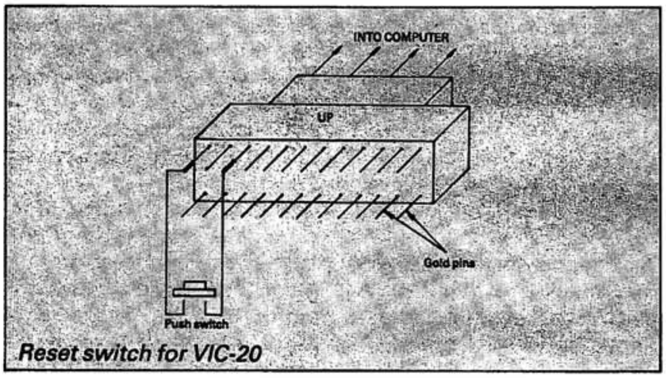
(3) Solder one piece of wire to the first pin on the left in the top row.
(4) Solder the other end to one pin on your push switch.
(5) Solder the other piece of wire to the third pin on the left in the top row.
(6) Solder the other end to the second pin on your push switch.

And there it is . . . a reset switch!

If you've correctly constructed your reset switch, you should now have a piece of hardware as shown in the diagram.

You should always try to insert the connector into your VIC correctly. However, it's unlikely that incorrect insertion would cause damage, as in this case reset would not work.

M Davies



Reset switch for VIC-20

USEFUL TIPS FOR MEMOTECH OWNERS

Here are a few useful tips for Memotech owners:

1. When reading or writing to the VDP control ports to control the screen, you should first disable cursor flash/sprite movement.

This is because the ROM sends its own data to the VDP ports when it updates the cursor or any sprites being animated from Basic, and this data can disturb your own VDP read or writes. So, before addressing the VDP directly POKE 64862,7 and POKE 64862,15 when you have finished writing.

2. If you miscalculate addresses or data when using the VDP it is easy to corrupt the character set. To get your character set back press — ESC,B,O.

3. Most of the Memotech's operating system is vectored via the system variables so it is possible to insert your own routines into the Basic interpreter, the Noddy interpreter or the Panel, to give those examples.

The system jumps to USERROR (FD54) whenever the Basic interpreter encounters an error, which contains the machine code instructions — JP 18AF.

Altering this to JP 8012 would jump to a user supplies routine at 8012. The cause of the error can be investigated by examining the keyboard buffer (FB4B) or by examining the area pointed to by ERRPOS (FD84).

In the same way, every time RET is pressed while in Noddy or the Panel, the system jumps to FEXPAND(FA9E) and USERNOD(FAA1) respectively.

Normally these locations contain the instructions — RET NOP NOP — but these can be directed to a user supplied routine if required using a jump instruction.

This feature of the Memotech allows you to create new instructions or commands to be used as standard commands alongside existing ones.

N Joynson

APRICOT BASIC LOGOS

After you have created a logo using the LOGOEDIT utility (see the *Configurators Guide* included with the Apricot), you may want to display the logo in one of your Basic programs.

This short program shows how a logo can be printed on the screen using Basic, and is written for clarity rather than efficiency.

If no logo has been created using the LOGOEDIT utility, the preset 'apricot' logo will be printed.

M Dennis

```
Program                                    Comments (not to be typed in)
 10 PRINT CHR$(14)                         Switches into second character set.

 20 PRINT CHR$(27)+“F”                     Enters graphics mode.
 30 PRINT CHR$(27)+“E”                     Clears screen.

 40 PRINT CHR$(27)+“Y*=”;                  Positions cursor down 11, across 30.

 50  FOR I=94 TO 114                       }
 60    PRINT CHR$(I);                      } Prints top line of
 70  NEXT                                  } logo.

 80 PRINT CHR$(27)+“Y+=”;                  Positions cursor down 12, across 30.

 90  FOR I=115 TO 125                      }
100    PRINT CHR$(I);                      }
110  NEXT                                  } Prints middle line of
120  FOR I=32 TO 41                        } logo.
130    PRINT CHR$(I);                      }
140  NEXT                                  }

150 PRINT CHR$(27)+“Y,=”;                  Positions cursor down 13, across 30.

160  FOR I=42 TO 62                        }
170    PRINT CHR$(I);                      } Prints bottom line of
180  NEXT                                  } logo.

190 PRINTS CHR$(27)+“G”                    Leaves graphics mode.

200 PRINT CHR$(15)                         Returns to default character set.
```

The table below shows the 21 × 3 grid in which the logo is created using the LOGOEDIT utility and the respective character codes for each square in the grid. This is useful if the logo does not consume the whole of the 21 × 3 grid.

94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123	124	125	32	33	34	35	36	37	38	39	40	41
42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62

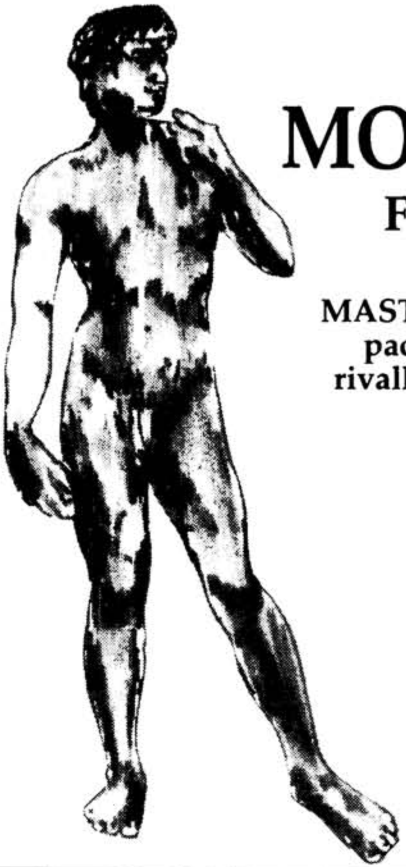
REVERSE VIDEO ATARI CHARACTERS

This routine enables you to reverse video a block of up to 255 characters from any position on an Atari Graphics 0 screen.

The routine is stored in the string REV$ and is called by the USR function. The format is:

X=USR(ADR(REV$,XPOS, YPOS,CHARS)

where xpos is the horizontal
position on the screen
(0-39)



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THESE PRODUCTS WILL BE AVAILABLE FOR CONASTA XXXIV AT SPECIAL INTRODUCTORY PRICES ypos is the vertical position on the screen (0-23) chars is the number of characters (starting from xpos, ypos) to be reverse videoed (0-255) on the screen.

N Pearce

```
100 GOSUB 900
200 GRAPHICS 0
210 POSITION 9,2:? "REVERSE VIDEO DEMO"
220 FOR I=0 TO 50
230 X=USR(ADR(REV$),9,2,18)
240 FOR J=0 TO 60:NEXT J:REM DELAY
250 NEXT I
300 LIST
320 FOR I=2 TO 14 STEP 12
330 X=USR(ADR(REV$),0,I,240)
340 NEXT I
500 END
899 REM *** REVERSE VIDEO ROUTINE -SETUP ***
900 DIM REV$(78):FOR I=1 TO 78:READ J:REV$(I)=CHR$(J):NEXT I:RETURN
920 DATA 104,104,104,133,207,104,104,133,208,173,48,2,133,203,173,49
930 DATA 2,133,204,160,5,177,203,133,206,136,177,203,166,208,240,10
940 DATA 24,105,40,144,2,230,206,202,208,246,24,101,207,144,2,230
950 DATA 206,133,205,104,104,168,240,21,136,177,205,170,41,128,208,5
960 DATA 138,9,128,208,3,138,41,127,145,205,152,208,235,96
```

JOYSTICK CONTROL ON THE ATARI

Here is a short routine to demonstrate a use of joystick control over cursor movements on the Atari.

It could be useful for cutting out input errors in programs with menus.

There is room for 20 items on the screen, but I've included only four examples. If the number of items is increased the value of Y will have to be changed.

P Williams

```
100 GRAPHICS 0: POKE 710,224 : POKE 712,224 :
    POKE 82,8:POKE 752,0
110 POKE 559,0 :POSITION 4,0: ?"[REV ON] MOVE
    STICK TO PICK PROGRAM":POSITION 4,1: ?"THEN
    PRESS TRIGGER TO RUN":?:?
120 POSITION 8,3: ?"01 LIST PROGRAM"
130 POSITION 8,4: ?"02 MAKE SOUND"
140 POSITION 8,5: ?"03 STOP SOUND"
150 POSITION 8,6: ?"04 EXIT PROGRAM"
160 FOR I=7 TO 22 : POSITION : 8,I : IF I<12 THEN
    ?"0";I- 2;"----------------":GOTO 180
170 ? I-2;"------------------"
180 NEXT I
190 X=8:Y=23:POKE 559,34
200 S=STICK(0)
210 IF S=7 AND X<39 THEN X=X+1:? CHR$(31);: GOTO 250
220 IF S=11 AND X>8 THEN X=X-1:? CHR$(30);: GOTO 250
230 IF S=14 AND Y>3 THEN Y=Y-1:? CHR$(28);: GOTO 250
240 IF S=13 AND Y<23 THEN Y=Y+1:? CHR$(29);
250 R=PEEK(84) : R=R-2 : IF R<1 OR R>4 THEN 200
260 IF STRIG(0)=0  THEN GOSUB 200*R+100: GOTO 280
270 GOTO 200
280 X=8:Y=23:GOTO 110
300 ?"[CLEAR]": POKE 82,0 : LIST : FOR W = 1 TO 500
    : NEXT W : POKE 82,8: ?"[CLEAR]":RETURN
500 SOUND 0,255,10,15 : RETURN
700 SOUND 0,0,0,0 : RETURN
900 GRAPHICS 0:POKE 82,0: END
```

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Hitch-hiker's Guide to the Galaxy

Are you searching for the meaning of Life, the Universe and Everything? Forget it! Tony Hetherington has found it in Infocom's humorous and impressive adaptation of Douglas Adams' Hitch-hiker's Guide to the Galaxy.

In the late seventies there was a radio series called *The Hitch-hiker's Guide to the Galaxy.* There then followed a second series and a book of the same name. Then a second book was written which was followed by another. Meanwhile it had become a television series screened here on the ABC, and also a stage play. Now it's a computer game.

It is, however, unlike any other computer game that I have played. Published by the American software house Infocom, and distributed in Australia by Imagineering, *The Hitch-hiker's Guide to the Galaxy* has all the trademarks of the excellent interactive fiction series, but there is a slight difference.

The game disk is accompanied by the demolition orders for your home and planet, a 'Don't Panic' badge, a piece of fluff, a small polythene bag (with which to attack microscopic space fleets) and the exceedingly useful peril-sensitive sunglasses — which you naturally cannot see through.

Adams is said to have enjoyed a number of Infocom's adventures and thought it would be a good idea to do one based on Hitch-hiker's. He initially contacted the company via a bulletin board and further discussions followed in a series of pubs (which was cheaper, although response time may have been slower) before Steve Meretsky was given the job of programming (Steve has previously written the Infocom adventures Planetfall and Sorcerer).

The resulting game is a curious mix of the humour and imagination of Douglas Adams and the depth and quality of an Infocom adventure. It is also a difficult adventure to solve.

Strategy

As with the other Infocom adventures Hitch-hiker's Guide consists of a series of logical problems which form the plot of a story in which you are the leading character. Your degree of success in tackling these problems determines the consequent route of the story.

You play the part of Arthur Dent and awaken one morning in a darkened room to discover that you have a dreadful hangover. On clambering out of bed and taking an aspirin you begin to feel slightly better: the irony of your situation is that this day will turn out to be the worst day of your life. In the next half hour your house is due to be demolished by a bulldozer (because it's simply in the way) and the Earth is scheduled to be destroyed by a Vogon constructor fleet to make way for a hyperspace bypass.

Just in time you and your friend, Ford Prefect, whom you always thought was from Guildford but is actually from a small planet near Betelgeuse, hitch a lift on the Vogon spaceship and the adventure continues.

If you've seen any of the previous versions of Hitch-hiker's and are now assuming that the game has the same plot and solution, don't. You're in for quite a surprise.

Although the characters are the same, and you'll come across similar creatures, places and situations, the difference is that you have to take a leading role rather than be lead through the action. A good comparison is *The Hobbit* by Melbourne House, wherein you play the part of Bilbo who is helped and lead through the story but takes the leading role in the game.

Therefore, it's up to you to find the answers to the obstacles which are placed in your way: you do, however, have some help in the dubious form of the *Hitch-hiker's Guide to the Galaxy.* This is an electronic book that you can consult about many things — but don't be too surprised if the editor for the section you require was out to lunch when the guide was compiled. As already stated the problems which you have to solve are logical and have logical solutions — but only if you apply the rather strange logic that exists in Hitch-hiker's.

To illustrate: the problem of getting a babel fish out of the babel fish dispenser. In the book and radio series Ford merely pops one into your ear but in the game you're not so lucky. After consulting the guide you realise that putting a babel fish in your ear is an excellent idea as it will allow you to understand and be understood by anyone or anything in the galaxy.

Consequently you are determined to get one so you press the button on the dispenser, but the fish shoots out the slot, across the room and through a hole in the wall. You notice that there's a hook

above the hole, so you hang your dressing gown on the hook in order to block the hole, and try again. But this time the fish hits the gown and falls down a drain. Not to be defeated in your objective you cover it with a towel. However, when the next fish lands on the towel, before you've had time to do anything, a cleaning robot charges in, picks up the fish and disappears through a robot panel near the floor. After some frantic hair-pulling you borrow Ford's satchel and place it in front of the panel and confidently depress the button.

Unfortunately, your lap of honour is interrupted by the following message: a single babel fish shoots out the slot. It sails across the room and hits the dressing gown. The fish slides down the sleeve of the gown and falls to the floor, landing on the towel. A split second later, a tiny cleaning robot whizzes across the floor, grabs the fish, and continues its breakneck pace towards a tiny robot panel at the base of the wall. The robot ploughs into the satchel, sending the babel fish flying through the air in a graceful arc. A small upper-half-of-the-room cleaning robot catches the babel fish and exits.

Don't be surprised if your computer acts strangely. At one stage I was informed that there was an exit to port but when I tried it, I was told that I couldn't go that way. In frustration I typed 'starboard' but was told that I could and had gone port and that it had lied before!

And don't be too easily deterred: your progress through the game will undoubtedly improve as you tune into the game's 'brand of logic', a state which I only achieved half-way through the third sleepless night spent hitch-hiking.

To help you get there, here's a brief description of some of the characters and creatures in Hitch-hiker's.

Ford Prefect is a researcher for the guide but unfortunately stayed on earth slightly longer than intended (six years) during which time he updated the guide's entry about earth from 'harmless' to 'mostly harmless'. For some reason beyond his apprehension he saved you, Arthur Dent, from the earth's extinction but then recovered his senses.

Together you are thrown into space by the Vogons where, just before you expire, you are picked up by the Improbability drive propelled spaceship, the 'Heart of Gold'. The new owner of this ship is Zaphod Breeblebox whom you once saw looking normal at a party, but now he has two heads. He is also president of the galaxy for which he got himself elected with the sole object of stealing the new Heart of Gold.

On board ship you meet Trillian, whom you previosly knew as Tricia MacMillian and first met at the same party. This is an incredibly improbable situation but, after all, the Heart of Gold is driven by the Improbability Drive.

The ship is also populated by products of the Sirius Cybernetics Corporation whose attempts to install Genuine People Personalities into machinery has unhappily resulted in Marvin the paranoid robot and an overprotective computer called 'Eddie'.

During your adventures you will also meet the Vogon captain who is green and blubbery and recites poetry (aaagh!), a warlike alien wearing black-jewelled battle shorts, and the incredibly stupid but equally dangerous and ravenous bugblatter beast of Traal. This incredibly stupid monster thinks that if you can't see it, it can't see you!

If you try something a little silly (which *could* be the answer, so it's always worth a try), it doesn't respond with the all-too-usual 'You can't do that'. Instead it either gives you a helpful error message or passes a comment which can range from 'You're letting things get to you too much, try and relax' through to Are you sure you're allowed to be playing with this computer?'

Well, how *do* you solve the problems in Hitch-hiker? Here are a few tips that I've gleaned from the game.

Once you have tuned into the game's *peculiar* logic, you should ensure that you read everything carefully (including this review). Every word and object in Hitch-hiker's are there for a reason — even if the reason is only to confuse you. Also you should consult the guide about anything and everything as it contains some important hints. Be prepared to try anything no matter how dangerous or silly it may at first seem; but before you do, use the game's save facility so that you can restore it if things don't turn out too well.

Finally, don't assume for one moment that the game is the same as the book or radio series; even your main objective is different.

Prices and availability

The Hitch-hiker's Guide to the Galaxy will be available on disk for numerous machines including the IBM PC (this was the version used for the review copy),

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HI-TECH C	40	100	4153
Whitesmiths	60	420	15745
C/80	63	140	3584
Aztec	78	144	9168

8086 BENCHMARK (IBM PC under MS-DOS)

Program: Eight Queens

Compiler	Execution Time	Compilation Time	Program Size
HI-TECH C	14	105	4500
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Apple II, Macintosh, DEC Rainbow, HP150 and 110, Commodore 64 and Atari. At the time of going to press only the Mac version was available through shops; it sells for $54.95.

Documentation

The guide is in a class of its own and even contains footnotes to its entries. These, of course, can be read and usually contradict what the guide has just told you. Just for fun I decided to read through the footnotes. When I came to footnote 10 the computer responded with: 'Isn't it fun reading through the footnotes?'

Conclusion

The Hitch-hiker's Guide to the Galaxy is the first Infocom adventure to have a strong outside influence in the shape of Douglas Adams. This has undoubtedly improved an already impressive format and produced a genuinely funny and challenging game. Infocom classes Hitch-hiker's as a Standard Level game but it's hardly Standard and more difficult to solve than some of the company's Advanced material.

There will be two groups of people who will particularly relish this game: the 'Hitch-hiker's' for whom this will be their first Infocom adventure; and the Infocom adventurers who will be introduced to the humour of Adams. Those lucky people who already know both won't be disappointed.

Last but not least, the *Washington Post* once said: 'If it's 2am it must be Infocom'. On the experience of the last few days I'd like to add: 'If it's 4am it must be Hitch-hiker's.

'Let's face it . . . "Chartered Accountants and Underground Railways" just doesn't have the same charismatic ring as "Dungeons and Dragons!"'

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Koala Pad

Martin Banks draws your attention to the Koala Pad, a touch-sensitive graphics unit for the Commodore 64 which allows aspiring computer artists to draw quality pictures easily.

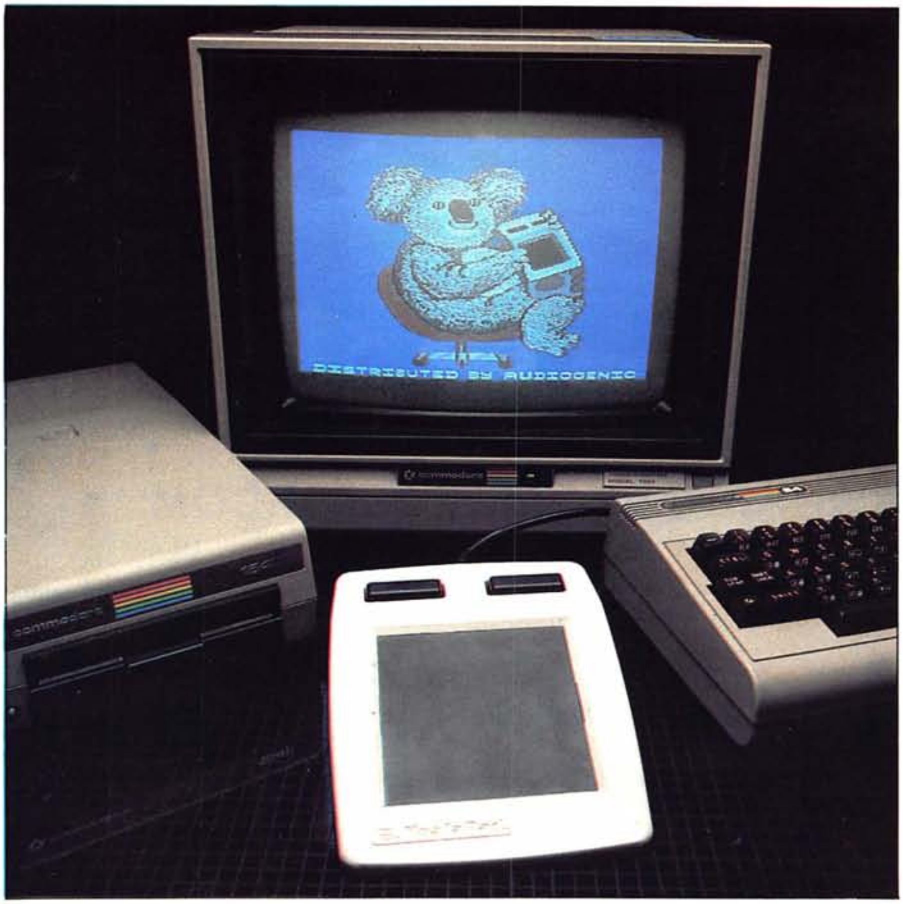
Have you ever looked at someone else's computer-generated graphics and said to yourself: 'I wish I could do that . . . '. and then given up on the idea because of the amount of program coding needed to achieve worthwhile results? I have. I've looked at some of the clever graphics around and thought it would be fun to try, if only it could be done more quickly and easily than the techniques currently presented.

The Koala Pad is an extremely simple device which enables graphics to be implemented with the utmost of ease, with virtually no tricks or skills to learn and with results that are interesting and entertaining, even for absolute beginners. The Pad has some weaknesses, but then it's not intended to be a professional 'hi-tech' device.

It is particularly aimed at the home and hobbyist market, and interfaces directly with the Commodore 64, the Atari range, the Apple II and the IBM PC. As can be seen from the latter systems it has pretensions towards business use, although its capabilities might be found to be wanting if put to serious use.

Hardware

The Koala Pad is manufactured by Koala Technologies Corp of California. The hardware consists of a touch-sensitive pad which measures 3.5ins by 4ins. This sits in a case measuring 6.5ins by 8ins which incorporates two keys, both of which perform the same function. The case is designed to be held in one hand (either left or right) with the thumb over the adjacent key. The other hand is then free to work with the pad area, either with the stylus provided, a finger, or with any other reasonably pointed and hard object.



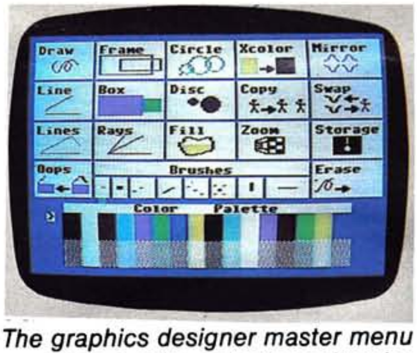
Software

The software has been produced by Audio Light Inc of California. It takes the form of three packages — Koalapainter, Koalaprinter and the Instant Programmer's Guide. These are fairly self-explanatory, with the first intended for the production of graphics, the second provides hard copy output of the results of the first, and the third package is aimed at those hobbyists keen to interface the Pad to other programs.

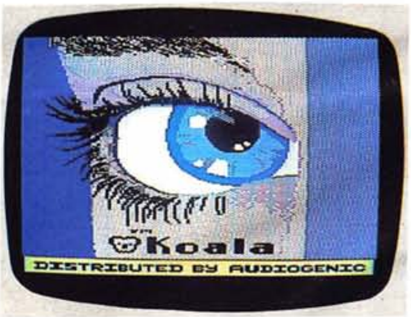
In use

Getting started with the Pad is straightforward with the 64, as its input signals mimic those of a standard joystick. The Pad is simply connected to port one of the computer, the cassette is loaded into the player, and you're ready to begin.

Enter LOAD "KPAINT" in response to



The graphics designer master menu provides a wide selection of tasks



Designing graphics is simple: every command and colour is provided the prompt; after the tape has been started there's about a minute to wait before the READY prompt appears again. Key in RUN and wait a further five or six minutes. The main menu then appears. This consists of a number of separate boxes, all containing a different command or function collected together in a rectangle. This constitutes the system's display area which is surrounded by a coloured border.

Now is the time to pick up the Pad and stylus, and twiddle with the television's volume control. This is necessary because, when the main menu is displayed, there is a continual and annoying mixture of buzz and white noise. The sound should not be turned off, however. Pressing the stylus onto the Pad will produce a bleeping sound from the television, which indicates that you can select from the main menu or change to the drawing in progress.

Move the stylus up the Pad and an arrow cursor appears on the screen's display area. Locate this in any of the boxes, press one of the two keys and the function or command in the selected box will become the current task.

Here's how it works in practice. The boxes contain such commands as DRAW, FRAME, CIRCLE, XCOLOUR (change colour), MIRROR, LINE, BOX, DISC, COPY, SWAP, LINES, RAYS, FILL, ZOOM, STORAGE, OOPS, BRUSHES, ERASE and, at the bottom of the display, a rectangular colour palette with 32 different colours or shades. To get started, move the cursor to the DRAW box and press one of the keys on the Pad. Next, move the cursor down to the bottom of the Pad until the bleeping is heard, when a key should be pressed again. This removes the main menu and leaves a blank display area inside the coloured border. Now move the cursor back up the screen into the display area; the arrow will appear accompanied by the selected command word, in this case DRAW.

Move the cursor to the point where you wish to start DRAWing, then press the key and keep it pressed; now move the cursor around and draw your picture. To move the cursor without drawing, either take the stylus off the Pad and relocate it or, more conveniently because you can see the movement, release the key until the cursor is in the right place. There are eight 'brushes' which can be selected for this purpose, all with a different effect. There's a narrow point for thin lines, broad brushes, and multiple brushes which allow you to draw several lines at once.

My major problem occurred when I placed the stylus on the Pad in DRAW command as it was impossible to keep the cursor still. The amount of movement was small, no more than a Commodore sprite or two, but the effect was tremendous. It was impossible to produce a straight line in free-hand, and every movement was subject to considerable deviation from the straight and narrow.

The manufacturer says this is expected of the device, partly because it isn't intended for such 'professional' hand drawing capabilities, and partly because it has a reasonable set of automatic drawing commands which largely overcome the problem. One major reason for the problem, according to the company, is that the Pad is so small that the drawing area is tiny: therefore, the merest hint of a hand tremor is translated into a major movement on the screen.

The automatic graphics commands incorporated into the software fall into two main categories: the linear ones, and the solid ones. The former contains LINE and LINES, FRAME, CIRCLE and RAYS. With each of these the basic approach is the same. Select the command from the main menu, then press a key on the Pad. Having selected the function which illuminates its selection by blinking in the menu, and brush and colour (both are chosen by placing the cursor over the selection and pressing a key on the Pad), return to the drawing display. Again, this is achieved by moving the stylus to the bottom of the Pad until the bleeping is heard and a key can be pressed.

Locating the cursor at the start point and pressing the key will fix the end of a line, the centre of a circle, or the top left hand corner of a rectangle. Move the cursor around until you have selected the position for the end of the line, diameter of the circle or bottom right hand corner of the rectangle and press the key again. The image will appear on the display as selected.

This is an extremely quick and easy way to create basic graphical shapes, and with imagination can be used quite effectively. It also overcomes the wobbly cursor problems.

The BOX and DISC commands are used in exactly the same way as FRAME and CIRCLE; the only difference being that once completed, the enclosed area is filled with the background colour of the border. The same effect can be obtained on other enclosed areas you have drawn by using the FILL command; simply locate the cursor over the area, which can be quite small, and press a key. Be sure, however, that you haven't left any holes through which the colour can 'escape', otherwise everything will be painted the same colour. The colour to be used for FILL is chosen by returning to the main menu and placing the cursor over the desired shade in the palette.

Of the other commands, XCOLOR allows you to re-fill an area with another colour choice, MIRROR reproduces what you DRAW in one corner of the screen as mirror images in the other three corners, COPY provides a 'step and repeat' facility for copying all or part of a drawing to another location, and ZOOM allows you to select a portion of the drawing and expand it into a much-enlarged window.

The SWAP command allows you to move picture information from one window to the other. ERASE wipes out the whole picture you have created, while OOPS simply cancels the last drawing command. STORAGE is fairly self-explanatory, being the picture saving and retrieving routine. It was here that the only weakness in the documentation was found, in that the retrieval routine, GET, is not fully explained in the manual.

There is an addendum sheet that accompanies the Pad which corrects the error, but you must remember to refer to it (guess who didn't first time round?). When GETting a stored picture, you first have to go through the NAME routine, which allows you to name a picture file prior to SAVEing it in order to identify the file to be retrieved. The GET routine is then used exactly as described in the manual.

Documentation

The documentation supplied with the unit is clear and concise, and contributes well to easy operation.

Prices

The Koala Pad costs $149.95 for the '64 (with the software on disk) and is available from Ozisoft, 'phone (02) 211 1266. Versions are also available for the Apple, IBM PC and Atari.

Conclusion

The Koala Pad and its software is easy to use and quick to give results. The system is high on entertainment value, but also educational and 'artistic'. It has some drawbacks, most notably the wobbly cursor and the need for two-handed operation which could prove a problem, but at the price it's an excellent exploitation of technology.

It also demonstrates how technology can be applied to business applications at a reasonable price. The Pad is a worthy competitor to a mouse and, although there wasn't sufficient time to fully evaluate the Instant Programmer's Guide package which allows you to write interfaces to other programs, it's a relatively easy task to accomplish.

Most of all, though, the Pad will appeal to all those budding computer artists who want to get on and draw the pictures but don't want to waste time forever programming sprites.

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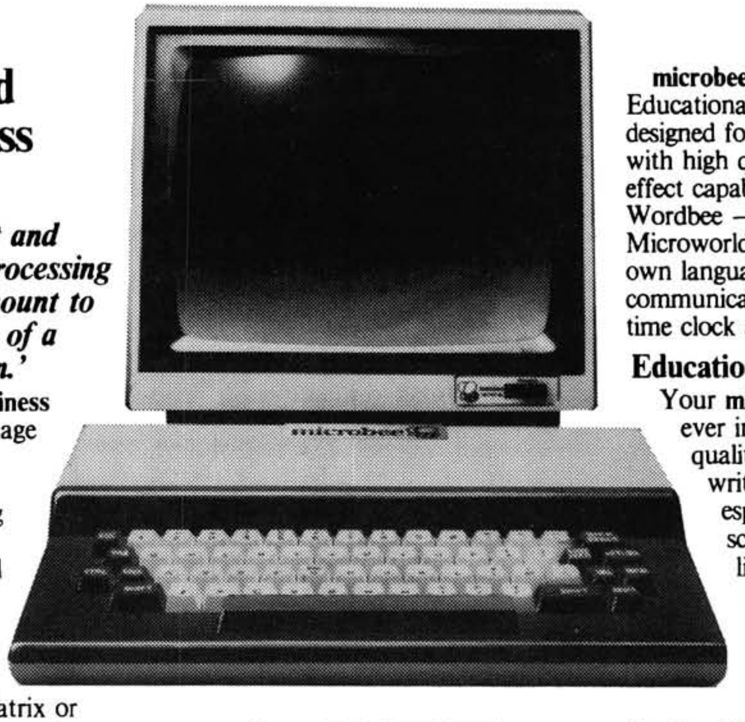

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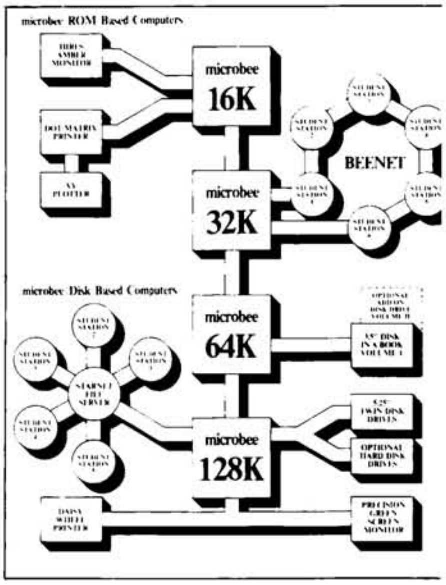

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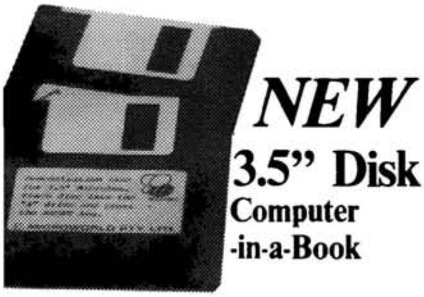

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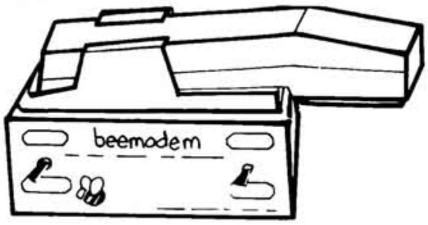

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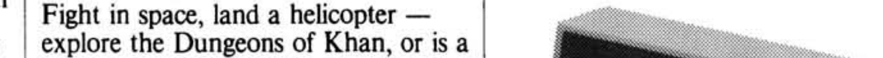

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Happy-go-lucky C

Les Hampson introduces the features of C, and explains how the language's versatility enables it to adapt to ever changing requirements.

Which high-level language do you think is used to produce many of the spreadsheets, databases, word processing applications and the integrated products now appearing? Which language has Digital Research (of CP/M fame) adopted for system development? Not Fortran nor Pascal, and certainly not Basic, but C.

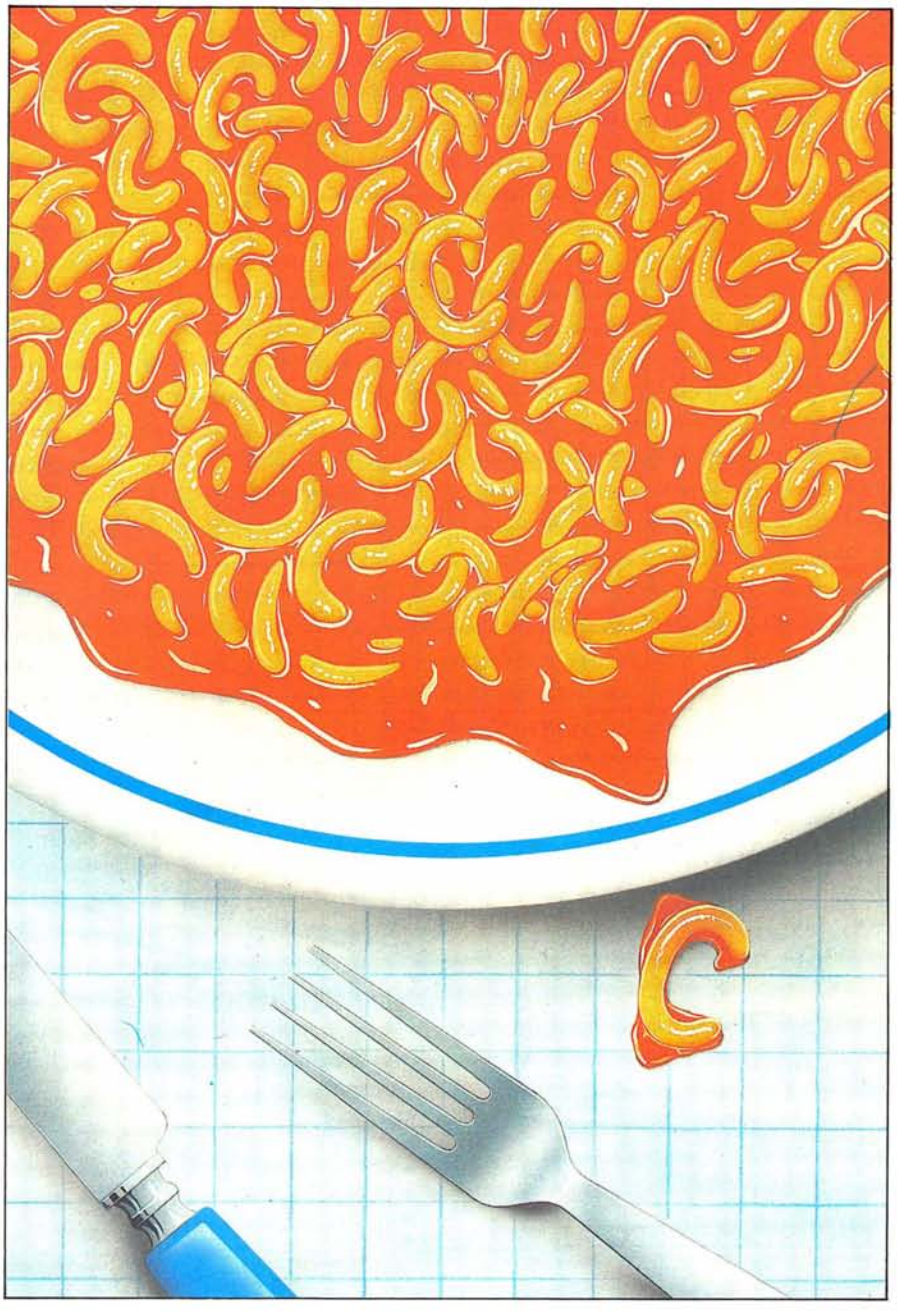
Why is C so popular with professional software writers? The answer is: because it is versatile, puts few constraints on what can be done, produces fast and compact programs, and allows software to be readily transferred between systems. Although C was conceived for 'systems programming' (which means writing things like operating systems), specifically developing the Unix operating system, it has proved useful for general applications.

C works well in many applications, and versions are available for almost all machines with disk drives. Some of the 8-bit versions are subsets of the language (for example, without floating point operations) but are still very useful; almost all 16-bit implementations provide the complete language. You probably don't want to write your own CP/M, a compiler, or an alternative to Multiplan, at least not just yet, but if you want an efficient, general purpose language, or need the flexibility of assembler without headaches, then C has a lot to offer.

The name itself reflects that C is not a verbose language, so let's jump straight in with a sample to show that it can be fairly easily understood. Fig 1 compares a simple loop in C and in Basic; a lot can be learnt from this example. C does not use line numbers and the program can be laid out as required, although everything on one line would be going a bit far. The types and names of variables have to be declared before use, unlike Basic which provides a variable when a new name appears (or even a mistype). The braces {} enclose groups of statements and each of these is terminated by a semicolon.

The general approach will be familiar to anyone who uses Pascal, especially when you realise that the braces correspond to BEGIN and END. Although you can use expressions like x = x + 1, C has special operators such as '++' to increment and '+=' to add to a variable because these can be more efficient.

What the example does not show are the advantages of using C: for such a trivial program there aren't any, and Basic has the advantage of being easy to get started in and can be run immediately.



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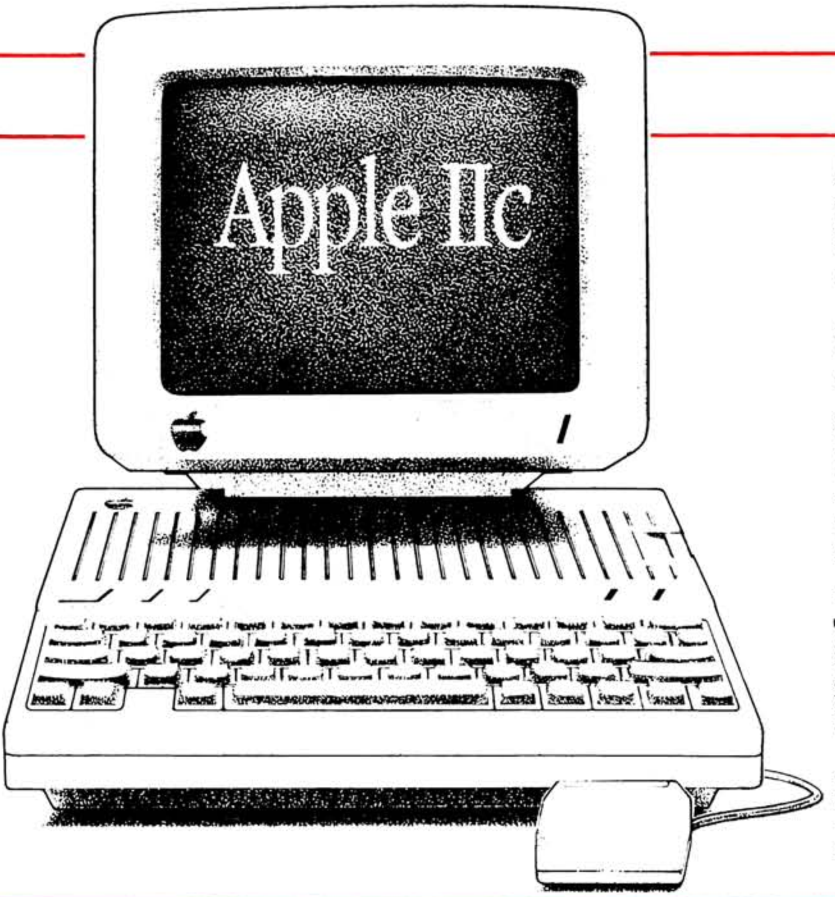

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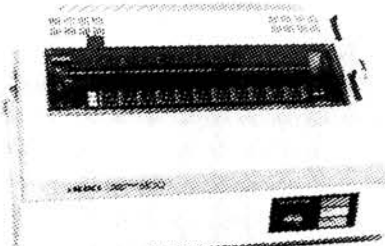

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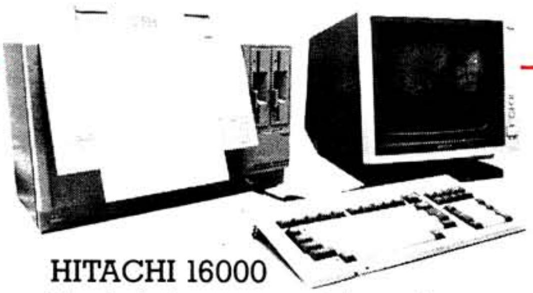

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```
In Basic                                        In C

10 for i=1 to 20 step 2                    main()
20 x=x+1                                      {
30 next i                                     int x,i;
40 print "finished ";x                        for(i=1,i<=20;i+=2)
50 end                                                  x++;
                                              printf("finished %d",x)
                                              }
```

Fig 1 A simple loop in Basic and in C

Version 1

```
/*
since 1 is always true (ie non zero) the loop will continue
until explicitly broken
*/

while(1)
    {
    c=getc(myfile);                       /*get a character from file*/
    if(c==EOF) break;                      /*exit loop at end of file */
    if(c==0) num_null=num_null+1;          /*increment if c is zero*/
    }
```

Version 2

```
while((c=getc(myfile))!=EOF)
            if(c==0) num_nul++;
```

Fig 2 Two loops showing different constructions

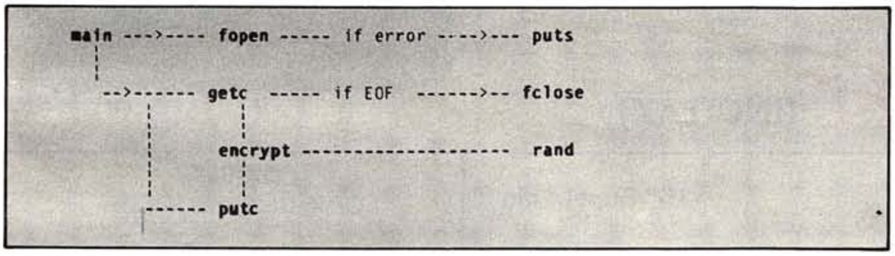

Fig 3 Structure for file encryption program

```
break continue
char short int long float double
extern unsigned static auto register
while for do if else goto return
switch case default
union struct
sizeof typedef
```

Fig 4 Keywords in C with specific meanings

But larger programs are better written in the structured way encouraged by C with full control over variables, rather than huge monolithic blocks of Basic with control jumping all over the place. A large, well written, C program, such as a text editor which might be 2000 lines, can be readily understood once you become familiar with the constructions used; on the other hand, a badly written C program can be very cryptic and difficult to unravel.

Before getting down to details let's look at another example. The first part of Fig 2 is another loop which gets characters from a file and counts the number of zeros. The loop is exited when the end of file is reached. The '= =' symbol tests equality, whereas '=' is used for assignment. In practice the second version, which does exactly the same job, would be preferred because it can be translated by a compiler into more efficient machine code. Although such concise constructions are common in C, they take some getting used to.

Using C

In general, C has to be compiled — there's no instant gratification as with an interpreter. A suitable package will include compiler, linker, function library and a text editor of some kind. These will, of course, have been written in C. Many versions also have utilities for maintaining function libraries. A few have a symbolic debugger, which allows you to run programs step-by-step while displaying the source code and to check the values in variables. A few C interpreters have been written but are not widely used.

The language is defined in an excellent reference text (*C Programming Language* by Kernighan and Ritchie, Prentice Hall, 1978). No extensions to the standard are required or generally available, thus eliminating the problem of confusing variants found with other languages.

Functions

Functions are the building blocks of a C program. A function is a series of instructions called by name to carry out operations such as read from a file, clear a display screen or manipulate numbers. These are much more powerful than the subroutines and defined functions of Basic, and have more in common with the built-in commands like 'sin' and 'mid$', except that you can write your own. A well-written C program will be broken up into numerous fairly small functions, either because these are used repeatedly or just in the interest of clarity.

Functions can carry out actions and return a value; parameters can be passed to them and they can use local variables not known outside. The function 'getc' in the second example returns a character read from a file identified by the parameter 'my file'. It might use various local variables, but since these are internal to the function we don't need to worry about them and can't affect them. C programs must contain at least one function and must contain a function named 'main'. A program starts executing at 'main', otherwise this is just a function like any other. The smallest C program, which does nothing at all, is

```
main ()
                                 {
                                 }
```

The name of a function is followed by brackets which enclose the names used to refer to any parameters passed to it. The braces then enclose the body of the function. One function can call another or even itself (that is, recursion) as required.

A reasonable first program, with only one defined function, might be:

```
main()
    {
    char c;
```

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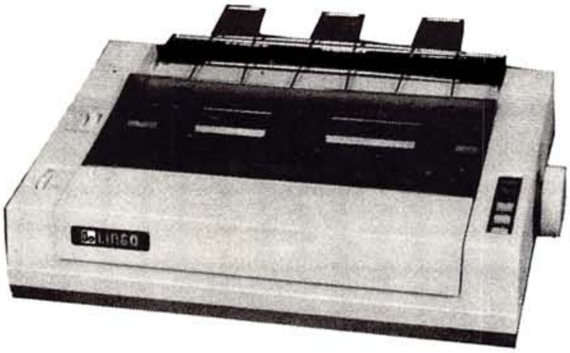

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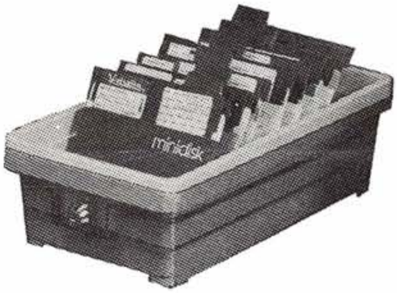

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```
/*
elements of a program to encrypt data in a file called
original.fil into one called secret.fil
*/

#include "stdio.h"

/*
The above directive reads in the file stdio.h which is
contains essential input/output definitions, including FILE
*/

#define EOF -1
#define REQUIRED 1
#define NULL 0

main()                                      /*main function*/
     {
     int c;                                 /*declare an integer*/
     FILE *in_file,*out_file;               /*declare file identifiers*/

     in_file=fopen("original.fil","r");     /*open for reading*/
     out_file=fopen("secret.fil","w");      /*open for writing*/

     if(in_file==NULL || out_file==NULL)
                    puts("File access error");  /*cannot open files*/
     else
          while(REQUIRED)                   /*loop until broken*/
               {
               c=getc(in_file);             /*get a character*/
               if(c==EOF) break;            /*exit loop if end of file*/
               c=encrypt(c);                /*encrypt the character*/
               putc(c,out_file);            /*and write it to the file*/
               }

     fclose(in_file);                        /*close the files*/
     fclose(out_file);

     }                                       /*terminate at end of main*/


encrypt(x)                                  /*encryption function*/
char x;                                     /*declare parameter passed*/
     {
     x=x^rand();                            /*encrypt the char by XORing with a
                                              random number*/
     return x;                              /*return encrypted character*/
     }
```

Fig 5 Skeleton encryption program

```
     for(c=32;c<127;c++)
       printf("%d %x %c/n",c,c,c);
     }
```

This will display the ASCII character set and give the decimal and hexadecimal equivalents. The loop calls a standard library function 'printf' which displays the information according to the format string between the quotes (decimal number, hex number, character and then a new line). Notice that the variable 'c' has to be declared before being used, and that it is incremented using the special '++' operator. As well as the format string which tells 'printf' how we want the printout, the names of the variables (all 'c' in this case) are passed to it. The 'for' loop is controlled by three expressions which define an initial condition, a termination test, and a modification after each time through.

Developing a program

C is a powerful and flexible language which can produce well-structured programs. Complex constructions can be elegantly expressed and data structures designed to suit the application. However, as in all things, there is a price to pay: the programmer is assumed to be right and few checks are made, which means that some errors can be truly spectacular. This 'Teach Yourself' series should lead you around common pitfalls, and as you write increasingly complex programs you will begin to appreciate the virtues of C and its brevity.

Large programs in C are best developed using a 'top-down' approach — that is, dividing the overall objective into logical sections and then into subtasks. Eventually a level is reached where the tasks can be conveniently constructed as C functions. It is also necessary to consider how information will be passed between the functions, and how data is best handled. Some planning effort before starting to write the program avoids the torture of sorting out tangled, unnecessarily complex and badly structured code.

C will not produce a fast-running program from poor ideas. The algorithms used are crucial in determining efficiency, as in any language. For example, if you were writing a spelling checker, then the methods used to sort words into order, check against the dictionary and use memory for disk buffering would have a major effect on the time your program took to run.

Suppose we want a program to encrypt data in a file so that it cannot be used by others. Fig 3 shows the functions which might be used.

The function 'main' first calls 'fopen' to access the file to be converted and to create a file for the encrypted version. If the files cannot be accessed, then 'puts' prints a message and the program finishes. A loop in 'main' uses 'getc' to get a character from the file, and passes it to 'encrypt'. This in turn needs to call 'rand' to produce random numbers needed for encryption, and finally 'putc' writes out the converted character to disk. When 'getc' finds the end of the file, the loop is exited; 'fclose' is called to close the files and the program ends.

Contents of a source file

What makes up a C source file (a program as written)? Lines can be of arbitrary length and use the full range of printable characters. There are few constraints on the layout of the program, which can be arranged as required for clarity. The examples in this series will align braces and make extensive use of indenting.

A source file consists of preprocessor directives, comments, global data declarations, and functions containing local data declarations and executable statements. These are built up from:

identifiers	— eg, my file
keywords	— eg, while
constants	— eg, 0
character strings	eg, "this is a message"
operators	— eg, +
separators	— eg, ;

Spaces, tabs, new lines and comments are ignored except that they separate adjacent identifiers, and so on.

Variables and functions are identified by suitable names, which preferably suggest their purpose. These must begin with a letter or underline and can contain digits. Identifiers can be of any length but only a limited number of characters will be significant (usually eight). The names of identifiers must not be certain C keywords which have special meanings (see Fig 4).

The name and type of a data item must be declared before use, so that memory can be reserved and the correct operations used to manipulate it. For example, to declare a *character*, an *integer* and a *float*ing point quantity the following statements could be used:

```
char c;
int i;
float f;
```

Data items can be made global (available from any function) by being declared outside functions, or local to a particular function by being declared inside. This is very useful because any data which is 'private' to a function can be made local; there is no conflict with names in other functions and the memory used can be released on leaving the function. Data is best communicated between functions using parameters and a returned value, rather than with global data.

The body of a function consists of statements constructed from keywords, function calls and expressions formed from operators and their operands. Each statement is terminated by a semicolon and is usually put on a separate line. Braces can be used to combine single statements into a block which is treated as a unit.

Comments of one or more lines are enclosed by the symbols '/*' and '*/'. C statements can be terse, so comments should be generously used.

A source file can also contain preprocessor directives which are simply instructions to the compiler. The directives begin with the '#' symbol; they do not end with a semicolon since they are not C statements, and are dealt with before any translation takes place. The basic use is illustrated by:

```
#define MAXCOLS 80
```

This will cause all occurrences of MAXCOLS to be replaced by the numerical constant 80. This is preferable to scattering obscure numbers through a source file and makes changes easier. The replacement symbol does not have to be a number; it can equally well be, say, a function call or character string. It is also possible to define symbols with arguments in the form of 'macro' definitions.

Function libraries

A program does not have to be contained in one source file. Larger programs, especially, are likely to consist of several files which are separately compiled and finally linked together along with required library functions to give something which runs.

Where do all the functions required in a program come from? It may come as a surprise to discover that C provides no built-in access to display, keyboard, printer nor disk file. Nor does it provide basic operations such as adding one string of characters to the end of another or taking the sine of an angle. The language can be used to do all these things (given some way of interfacing with the operating system), but suitable functions have to be devised.

This sounds distressing, but fortunately the user is not required to write such functions because they will be provided in a library with the compiler; a program simply calls them. However, the library functions are not an intrinsic part of C. Most implementations try to follow the functions provided with Unix, but as they are not part of the language, this is in the hands of the software author. We will be looking at the functions you would expect to be provided with later on in the series.

Two basic functions which are always provided are 'getchar', which returns a character typed in, and 'putchar' which displays a character on the display. Using only these it is possible to experiment with many of C's features.

In writing your own programs, you will probably devise functions which are of general value. If these use local variables, passed arguments and a returned value, then they can *stand alone* and be added to a personal library. This is the 'toolbox' approach which leads to a specialised library to suit particular interests.

The program in Fig 5 fleshes out the skeleton encryption program to illustrate C. It should be possible to understand how the program works and the way in which functions are used, even if some of the details are not yet clear.

The functions 'fopen', 'fclose', 'puts', 'getc' and 'putc' or equivalents would normally be in the supplied library. If the function 'rand' is not available, then a programmer could write his own version for inclusion in a personal library.

The function 'main' has been put first; this is common but not essential. Of course, if a program consists of several source files, then only one will contain main.

This program could be developed for actual use: a password could be entered and converted into a seed for the random number generator and the original file deleted once the converted version had been successfully stored. Since the XOR operation is reversible the same program could translate the file back to the original form (it would be best to include checks for file operation errors).

A number of questions arise. Why is a variable to hold a character c declared as 'int' in main, and x as char in encrypt? How can a number be XOR'ed with a function? Is it possible to call the program with the names of the files to be used rather than have them built into the program? The following four articles will cover these and many other points in detail.

To help you get the best from the Teach Yourself C series, we've produced the table below which lists most of the commercially available C packages.

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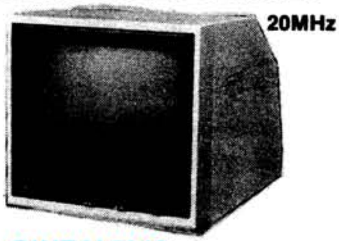

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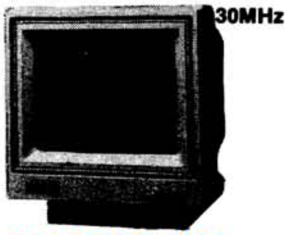

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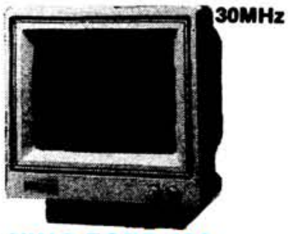

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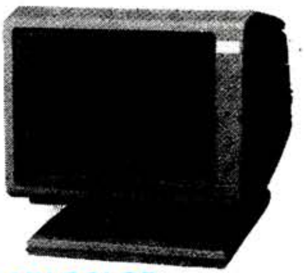

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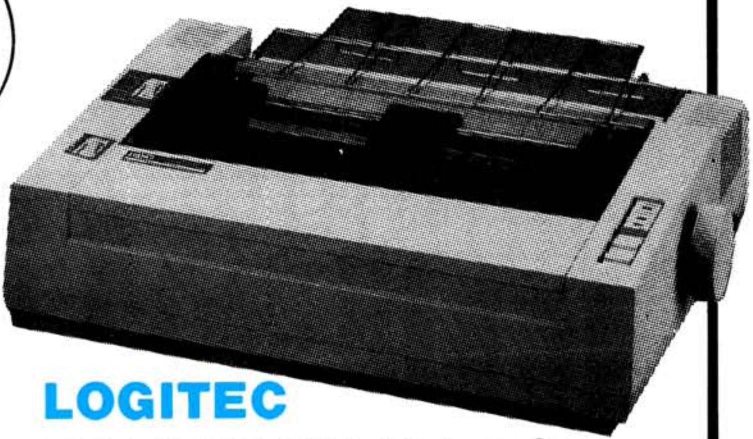

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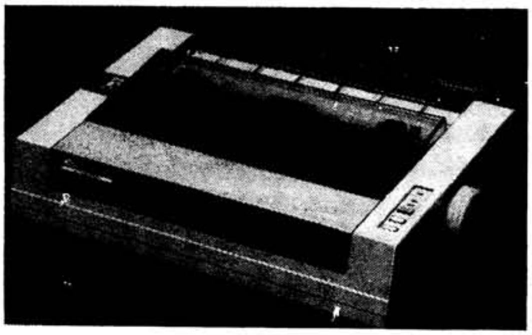

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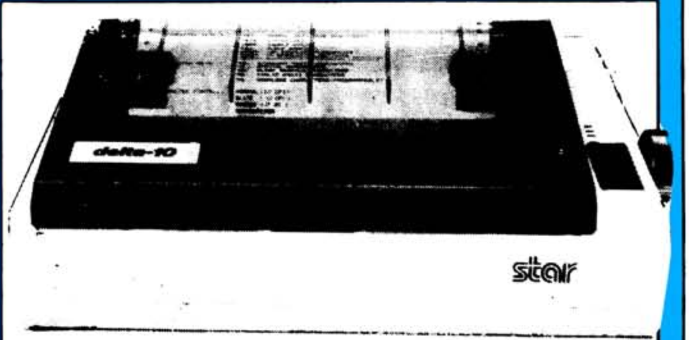

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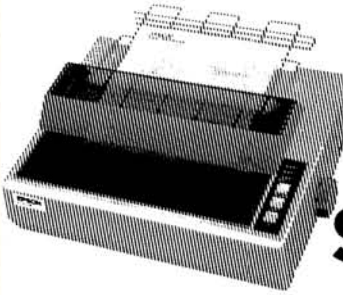

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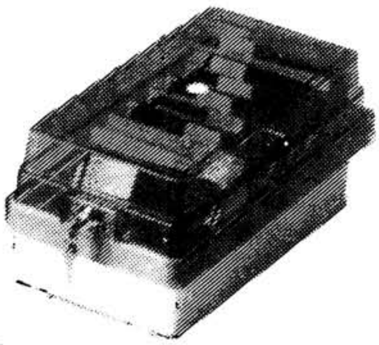

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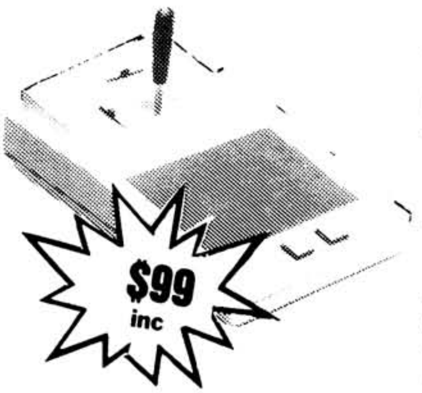

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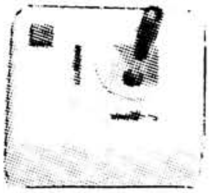

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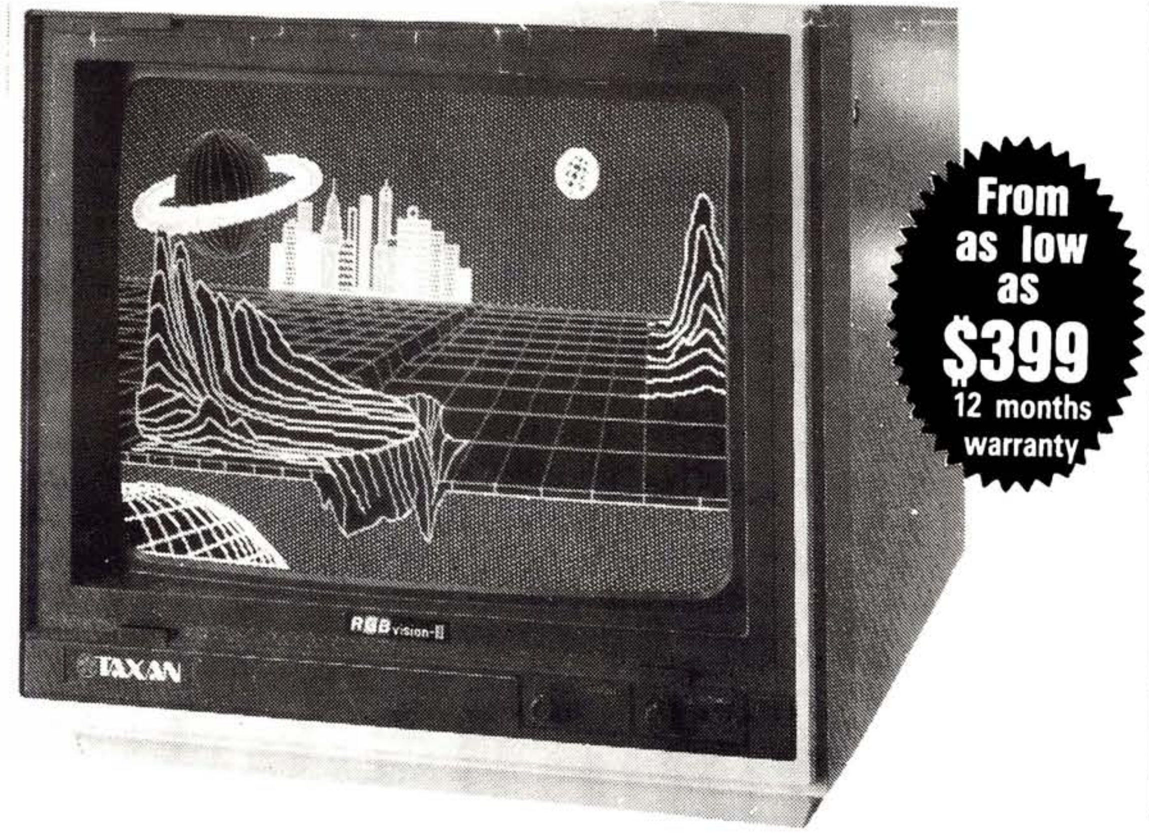

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The basic art

Mike Liardet, aided by 'The Art of Computer Programming', presents a beginner's guide to Basic programming through algorithms and information structures.

Computer programming is a craft. Given the raw ingredients of a programming language, a skilled programmer can blend them together into a fine working system by using his problem solving skill in conjunction with programming techniques that he has developed over a period of time. In an analogous fashion a traditional craftsman (a carpenter, for example) can transform a few pieces of wood into an exquisite piece of furniture by using different types of joints and various skills acquired over the years.

As with any craft the acquisition of skill comes partly with experience, but it can be more readily acquired by sound teaching and well-written text books. A valuable source of reference for anyone wanting to learn programming lies in a three-volume set of books by an American academic, Donald Knuth. These books are collectively entitled *The Art of Computer Programming**.

Knuth has planned seven volumes in the series, and has completed three volumes to date. Volume one introduces the basic concepts and defines what an 'algorithm' is, giving numerous examples; it also deals with 'information structures'. Volume two covers random numbers and arithmetic, and volume three deals with sorting and searching.

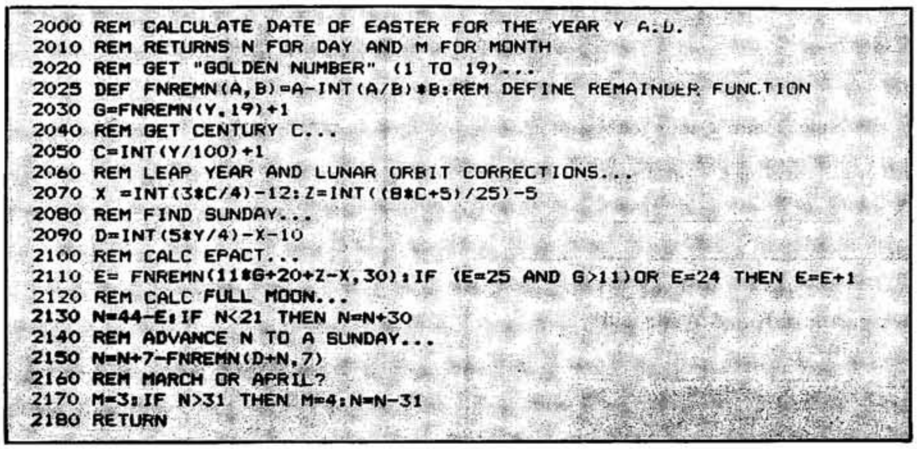
The books present the material as a pleasing blend of descriptions, formal presentation and set problems (and answers), and there are also interesting background histories and bibliographies. They have long been the computer science student's bible, but here they are presented for a new generation of apprentice programmers learning their craft outside the confines of academe. These books will be invaluable to anyone interested in what goes on 'under the bonnet' of computer systems.

Apart from the genuinely useful material, the books are also rich in a huge variety of algorithms that you always knew existed but were unable to find. One of my favourites is the algorithm to calculate when Easter falls (Fig 1). Easter is the first Sunday following the first full moon on or after 21 March. Did you know that this algorithm was devised by a Neapolitan astronomer in the sixteenth century? And that the only application of arithmetic in the Middle Ages was for determining Easter? Oh, yes — the volumes are a mine of information!

Knuth has invented an assembly language called MIX, which he uses to present the algorithms. We'll convert some of these MIX programs into the micro world's *lingua franca* — Basic.

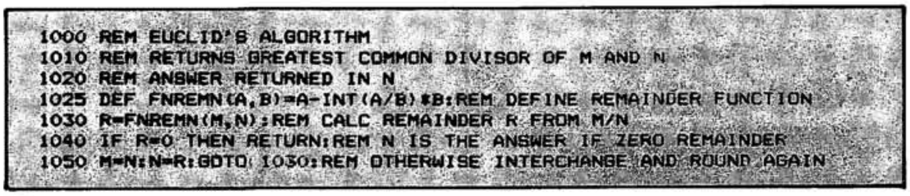
Introduction

Volume one contains general introductory material, and begins by defining



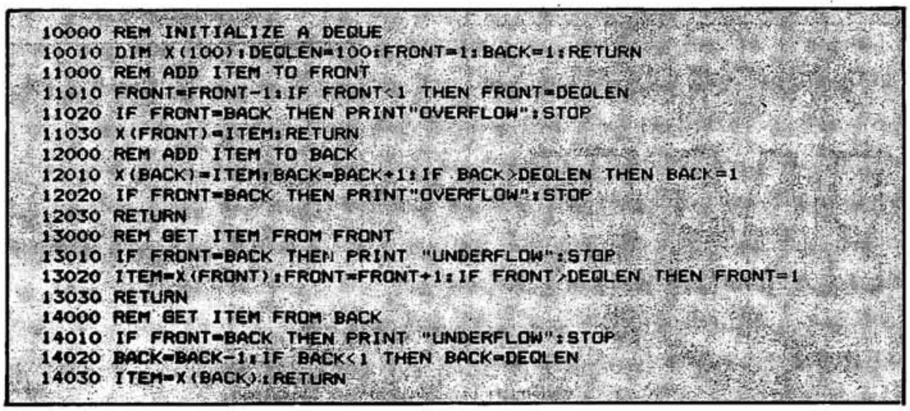
```
2000 REM CALCULATE DATE OF EASTER FOR THE YEAR Y A.D.
2010 REM RETURNS N FOR DAY AND M FOR MONTH
2020 REM GET "GOLDEN NUMBER" (1 TO 19)...
2025 DEF FNREMN(A,B)=A-INT(A/B)*B:REM DEFINE REMAINDER FUNCTION
2030 G=FNREMN(Y,19)+1
2040 REM GET CENTURY C...
2050 C=INT(Y/100)+1
2060 REM LEAP YEAR AND LUNAR ORBIT CORRECTIONS...
2070 X =INT(3*C/4)-12:Z=INT((8*C+5)/25)-5
2080 REM FIND SUNDAY...
2090 D=INT(5*Y/4)-X-10
2100 REM CALC EPACT...
2110 E= FNREMN(11*G+20+Z-X,30):IF (E=25 AND G>11)OR E=24 THEN E=E+1
2120 REM CALC FULL MOON...
2130 N=44-E:IF N<21 THEN N=N+30
2140 REM ADVANCE N TO A SUNDAY...
2150 N=N+7-FNREMN(D+N,7)
2160 REM MARCH OR APRIL?
2170 M=3:IF N>31 THEN M=4:N=N-31
2180 RETURN
```

Fig 1 Easter algorithm



```
1000 REM EUCLID'S ALGORITHM
1010 REM RETURNS GREATEST COMMON DIVISOR OF M AND N
1020 REM ANSWER RETURNED IN N
1025 DEF FNREMN(A,B)=A-INT(A/B)*B:REM DEFINE REMAINDER FUNCTION
1030 R=FNREMN(M,N):REM CALC REMAINDER R FROM M/N
1040 IF R=0 THEN RETURN:REM N IS THE ANSWER IF ZERO REMAINDER
1050 M=N:N=R:GOTO 1030:REM OTHERWISE INTERCHANGE AND ROUND AGAIN
```

Fig 2 Euclid's algorithm



```
10000 REM INITIALIZE A DEQUE
10010 DIM X(100):DEQLEN=100:FRONT=1:BACK=1:RETURN
11000 REM ADD ITEM TO FRONT
11010 FRONT=FRONT-1:IF FRONT<1 THEN FRONT=DEQLEN
11020 IF FRONT=BACK THEN PRINT"OVERFLOW":STOP
11030 X(FRONT)=ITEM:RETURN
12000 REM ADD ITEM TO BACK
12010 X(BACK)=ITEM:BACK=BACK+1:IF BACK>DEQLEN THEN BACK=1
12020 IF FRONT=BACK THEN PRINT"OVERFLOW":STOP
12030 RETURN
13000 REM GET ITEM FROM FRONT
13010 IF FRONT=BACK THEN PRINT "UNDERFLOW":STOP
13020 ITEM=X(FRONT):FRONT=FRONT+1:IF FRONT>DEQLEN THEN FRONT=1
13030 RETURN
14000 REM GET ITEM FROM BACK
14010 IF FRONT=BACK THEN PRINT "UNDERFLOW":STOP
14020 BACK=BACK-1:IF BACK<1 THEN BACK=DEQLEN
14030 ITEM=X(BACK):RETURN
```

Fig 3 Deque processing

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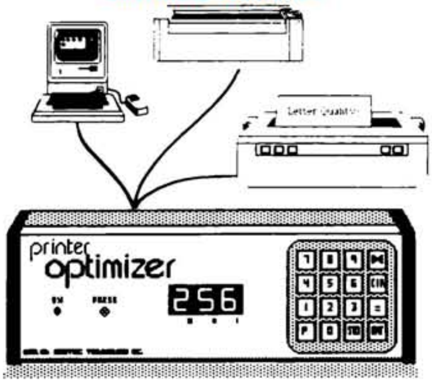

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Maimum number of computed fields	254
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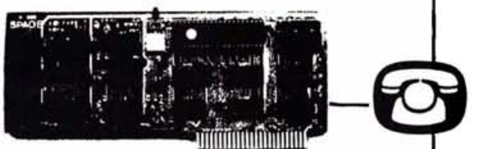

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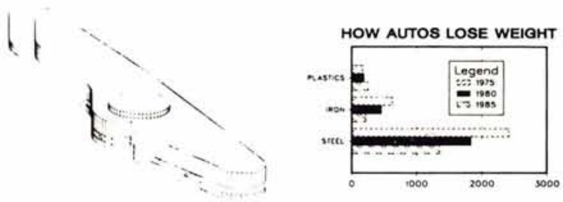

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the word 'algorithm'. An algorithm is an unambiguous set of rules for performing a task which must be expressed in such a way that the algorithm always terminates. This condition is important. It is relatively easy to construct procedures that never terminate under some conditions — the 'infinite loop' that should be familiar to all programmers.

One of the earliest algorithms to be formally presented as such was Euclid's Algorithm to determine the greatest common divisor of two integers. (The greatest common divisor, or GCD, is the largest number that will divide both: for example, the GCD of 12 and 30 is 6.) The Basic variant is presented in Fig 2. The algorithm requires a 'remainder' or 'modulus' function; most versions of Basic don't have one, but the DEF FN facility can be used to create one:

```
DEF FNREMN (A,B) = A – INT (A/B) * B
```

Following the introduction to algorithms, Knuth outlines the basic mathematics needed to study some of the subsequent material. Unless you're mathematically inclined this is rather daunting, but fortunately isn't mandatory: the mathematics is needed for the theoretical study of the algorithms. The theory arises because it isn't sufficient to know that an algorithm will work; it's also important to know that it will work reasonably quickly. Determining information of this type can be very complex, and some of the material is devoted to it. However, if you're non-mathematical, or in a hurry, or both, you can safely skip this analysis and read the conclusions, not the proofs.

The next section describes the MIX assembly language, devised by Knuth and used in the description of some of the algorithms. (Descriptions are also given in a more familiar English-cum-programming language.) MIX is roughly equivalent to a typical 8-bit or 16-bit assembler available for most micros, but being a Knuth invention it doesn't commit the book to any one computer. Among other things the code for a MIX simulator is given, so if you're really keen you can get MIX up and running on your own machine and use it to work through some of the exercises. This is a good way to learn assembler programming.

Information structures

Following the introductions, volume one gets down to business with a comprehensive guide to information structuring. Most interesting programming tasks, especially non-numerical work, demand some skill at structuring data. In fact, some programming languages implement many of the facilities described by Knuth. Artificial Intelligence languages, such as Lisp, Prolog and Logo, are particularly rich in these features, but if you're working with other languages, Basic for example, then Knuth provides a thorough grounding for building up these facilities from scratch.

```
LIST
 !
 !
 V
+-----+--+   +-----+--+   +-----+--+   +-----+--+   +-----+--+
! 101 ! ---> ! 102 ! ---> ! 103 ! ---> ! 104 ! ---> ! 105 ! 0!
+-----+--+   +-----+--+   +-----+--+   +-----+--+   +-----+--+
```

Fig 4 Diagrammatic linked list

```
LIST
 !
 !
 V
+-----+--+   +-----+--+   +-----+--+   +-----+--+   +-----+--+
! 101 ! ---> ! 102 ! --+  ! 103 ! ---> ! 104 ! ---> ! 105 ! 0!
+-----+--+   +-----+--+!  +-----+--+   +-----+--+   +-----+--+
                       !
                       +------------------+
```

Fig 5 Insertion and deletion by manipulating pointers

```
LIST
 !
 !
 V
+-----+--+   +-----+--+   +-----+--+   +-----+--+   +-----+--+
! 101 ! ---> ! 102 ! ---+ ! 103 ! ---> ! 104 ! ---   ! 105 ! 0!
+-----+--+   +-----+--+ ! +-----+--+   +-----+--+   +-----+--+
                        V      ^
                    +-----+--+ !
                    !102.5! ---+
                    +-----+--+
```

Fig 6 Adding a new node to the list

The most elementary structure is the sequentially allocated list, simply represented in Basic as a one-dimensional array: for example, DIM X(1000). This structure is quite adequate for tasks where the data to be stored is fixed during initialisation and left alone thereafter, but it can be cumbersome for dynamic structures, where elements may be added and deleted 'at random' throughout program execution. In order to insert an element at some point, all the elements after it must be shuffled along to make room, which can be very inefficient if the list has more than a few elements. Likewise, a deletion necessitates a shuffle in the other direction.

There's a special case where this arrangement *can* work efficiently, and this is when all insertions and deletions take place only at the ends of the list; this is known as a 'deque'. The deque concept includes two further, even more special, cases — the 'stack' and the 'queue'. Stacks add or delete data from one end, and queues add data at one end and remove it from the other. Both are very widely used — queues for buffering characters prior to processing, and stacks for managing computations on recursive structures.

The code for the four basic deque operations, plus initialisation, is given in Fig 3. Two variables (FRONT) and BACK) are used to mark the position of the ends of the deque. This should be obvious but some care is needed to check for 'overflow', when no further storage is available to accommodate an insertion, and 'underflow', when no data is there to be deleted.

It's also convenient to use the elements in the array as if they were arranged in a circle, so that the third follows the second which follows the first, but the first also follows the last. Queuing operations propel the deque through memory and without this trick would quickly fail, even if the deque were comparatively empty. Note that the BACK pointer marks the next position for an addition to the back of the deque, not the position of the last element. This wastes one location in the array, in the sense that an overflow will occur when one location is still free, but without doing this it is much more difficult to differentiate between an empty deque and an overflowed one.

Knuth devotes a lot of attention to the issue of storage management, as good storage management minimises problems with storage overflow. For example, if there are several stacks, queues or deques used by a program which are all initialised with fixed capacity, the program fails as soon as one overflows even though many of the others are almost empty. This unsatisfactory state of affairs can be improved by arranging for all the available storage to be pooled, then allocated in small chunks as it's needed. If a deque overflows, a larger storage area can be requested from the pool, the data copied across, and the old storage area returned to the pool of free storage. Storage management is also useful for handling any other information structures, such as linked lists. The linked list solves the insertion-deletion problem of the sequentially allocated list. Each item in the list is stored along with a pointer to the next, which therefore need not be adjacent in memory. For example, a list of the numbers 101 to 105 can be represented in memory as follows:

Location	**Contents**	
	Data and Pointer	
1 & 2	101	7
3 & 4	not used	
5 & 6	103	11
7 & 8	102	5
9 & 10	105	0
11 & 12	104	9
13 onwards	not used	

In this example, both data and pointer each require one storage location, but it's possible to have lists where this is not the case and even where the amount of data varies between the different 'nodes'. The pointer following 105 is 0. As 0 is an impossible location (in this example), this indicates the end of the list. A linked list can be drawn diagrammatically as in Fig 4.

Insertion and deletion in a linked list is handled by manipulating the pointers: for example, deleting the node with 103 is achieved by changing 102's pointer (Fig 5).

Ideally, the node at 103 should be handed back to the pool of free storage so that its storage area can be re-used later: for example, if you wanted to add a new node to the list (Fig 6).

Apart from their use in representing live data, linked lists also form the basis of many storage management algorithms. At any given moment in the program's execution, the free storage will be in several isolated fragments. A single variable indicates the location of one — any one will do. This contains a pointer to another, and so on. Unless all allocations and deallocations are for a fixed size, the size of each will need to be recorded. As long as the node is large enough this can be stored with the pointer, thus each free node may start with a size value, then a pointer, and then the remaining free space. Assuming the pointer and size value each consume one location, a typical free list is shown in Fig 7.

'. . . if you're really keen you can get MIX up and running on your own machine and use it to work through some of the exercises. This is a good way to learn assembler programming.'

The code to manage such a storage list is given in Fig 8, and demonstrates that there's nothing difficult about storage management. The free storage area is the array X(), which is initialised as just two free blocks; the first of length 2, with the second immediately following it and occupying the rest of the array. The first block is never allocated, but is kept solely for its pointer to the next free block. If this pointer were held in a variable, FREELIST, for example, then changes to the first block would need to be coded as a special case since they would alter the value of FREELIST and not a pointer in X(). In this example, all storage requests must be for an even number of locations as this will guarantee that no free blocks of length 1 are created. (A block of length 1 cannot contain a pointer *and* a length value.) The deallocation routine can be made a lot more effective by arranging for adjacent free blocks to be merged together. As it stands, storage will become more and more fragmented until the free storage is just a long chain of tiny blocks.

Knuth has much more to say on storage management including garbage collection, where it's unnecessary to explicitly free a block when it's no longer needed — the system can work this out for itself. There are also many alternative algorithms for maintaining freelists, each with pros and cons which are discussed at length.

Another major type of information structure is the 'tree'. A tree is more complex than a linked list in that each node contains several pointers, not just one. The pointers are to the 'children' of the node (the jargon for computer trees borrows heavily from that of family trees); these children in turn may point

```
FIRSTFREE
  !
  !
  V
+-----+-----+----------------------+
! 12  !  !  ! 10 unused locations  !
+-----+--!--+----------------------+
         !
  +------+
  !
  V
+-----+-----+----------------------+
! 24  !  !  ! 22 unused locations  !
+-----+--!--+----------------------+
         !
 etc....etc
  !
  V
+-----+-----+----------------------+
! 18  !  0  ! 16 unused locations  !
+-----+--+--+----------------------+
```

Fig 7 Typical free list

```
20000 REM INITIALIZE FREE STORAGE AREA
20010 DIM X(1000)
20020 X(1)=2:X(2)=3:X(3)=9998:X(4)=0
20030 RETURN
21000 REM RESERVE N UNITS OF STORAGE. ADDRESS OF BLOCK IN LOCN
21010 Q=1
21020 P=X(Q+1):IF P=0 THEN PRINT"STORAGE OVERFLOW":STOP
21030 IF X(P)<N THEN Q=P:GOTO 21020
21040 K=X(P)-N:IF K=0 THEN X(Q+1)=X(P+1):GOTO 21060
21050 X(P)=K
21060 LOCN=P+K:RETURN
22000 REM RETURN N UNITS OF STORAGE AT LOCN .
22010 X(LOCN)=N:X(LOCN+1)=X(2):X(2)=LOCN:RETURN
```

Fig 8 Storage management routines

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to grandchildren, and so on. It isn't usually desirable for each node to have a different number of pointers, depending on the number of children, so frequently just two pointers are used: one to the first child; and another to the next sibling of the node. For example, the tree structure:

```
      A
     / \
    /   \
   /     \
  B       C
  !      /!\
  !     / ! \
  D    E  F  G
```

is represented with two pointer nodes as:

```
        A
       /
      /
     /
    B>>>>>>>>C
   /        /
  /        /
 D        E>>F>>G
```

(where '>> . .' denotes sibling pointers). With this structure it is only slightly more difficult to access, say, the Nth child of a node, than it would be with multiple pointers. Note that A, C, D and G have no 'younger' siblings, so their pointers are simply null. Likewise D, E, F and G have no offspring.

Tree structures can be very useful for working with mathematical expressions, where the tree structure exactly represents the order of evaluation: for example, 3 * LN(X + 1) − A * X^2 is represented as a tree:

```
          -
         / \
        /   \
       /     \
      *       *
     / \     / \
    /   \   /   \
   3    LN A     ^
         !      / \
         !     /   \
         +    X     2
        / \
       /   \
      X     1
```

Knuth develops all the algorithms necessary for symbolically differentiating such a tree. The answer is generated as another tree structure, and issues such as copying tree structures, and ordering the nodes for evaluation, are all dealt with along the way.

With the above representation, it's not readily possible to determine the parent of a node as there are no pointers back to it. In tree processing, it's usual to maintain a stack of the parents *en route* to the current node — the earlier work on stacks and queues is of value here. It's also possible to use the null pointers of childless or youngest-sibling nodes to point back; this is called a threaded tree. It has the advantage that no stack is needed, so it's impossible for it to overflow. To determine whether your Basic interpreter uses threaded or unthreaded trees for evaluation of expressions, type:

```
PRINT ((((..(((3 + 4)))..))))
```

for ever more pairs of brackets. If it eventually gives a memory error, this is a strong indication that it's using a stack for handling the evaluation. Microsoft's Basic finally runs out of space with 72 pairs of brackets — not a serious limitation!

The last major topic to be covered under Information Structures is the 'array', which is represented in Basic by the multiply dimensioned use of DIM. For example, DIM A(3,3,3) defines a 3D array with 27 elements (or 64 if the lower bounds are 0 and not 1).

Representing arrays in this fashion can be highly inefficient if the contents of the array are sparse. Some arrays are triangular, with all zeroes above the diagonal, or diagonal with all zeroes except the diagonal, and so on. Knuth suggests a linked allocation method for these circumstances. Each non-zero element in the array is represented by a node containing the value, its row and column numbers, and pointers to the next (non-zero) node above it and to the left of it. Zero elements are not there, so consume no extra storage. In addition, each row and column starts with a dummy node, not an array element, but eases the processing of empty rows and columns.

A further refinement is for the linkages to be 'circular'. This means that the pointer in the last node of a sequence is not null, but points to the first node. With this scheme of pointing, the notion of first and last disappears. Such an array, containing only three non-zero elements, is shown in Fig 9.

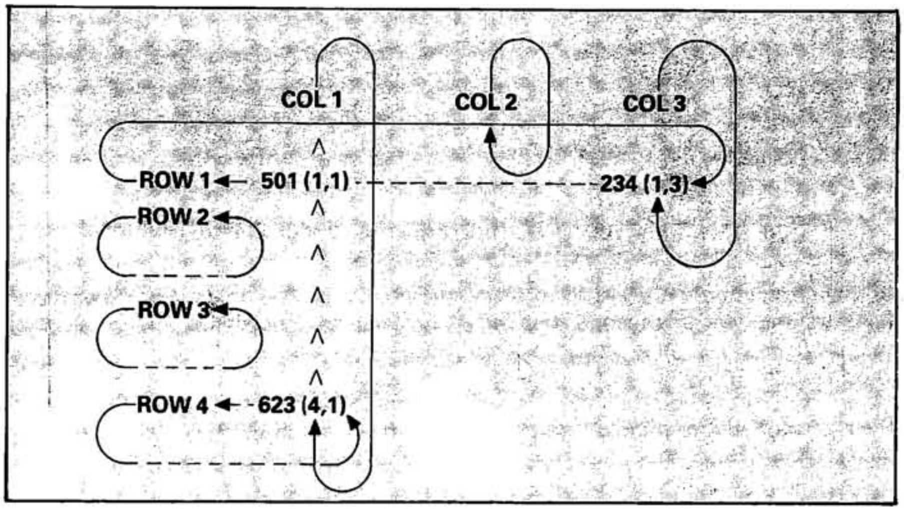

Fig 9 Circular array containing three non-zero elements

With this type of structure, great storage savings can be made with large sparse arrays, and the access time for any given element need not be excessive.

As the array is sparse there should be only a few elements on each list. This means that it should be comparatively fast to find any element.

It's even faster if the array is being scanned in some systematic fashion, as is the case with most numerical algorithms. It's also worth noting that this type of representation allows for new rows and columns to be inserted with minimal changes to the structure, or data moving.

Conclusion

We have taken a look at the first of Knuth's *Art of Computer Programming* volumes, and introduced most of the major topics dealt with in the book. I hope the reader's appetite for improving his programming techniques is sufficiently whetted, and strongly recommend this book as an instructor and reference manual.

**References*

The Art of Computer Programming *by Donald E Knuth; Addison-Wesley Publishing Company.*
Volume 1 Fundamental Algorithms.
Volume 2 Seminumerical Algorithms.
Volume 3 Sorting and Searching.

END

On your marks

See how they run: APC presents its Benchmarks round-up.

Bumper to bumper they turn into the final straight, with only seconds between them. Which will be first across the line? Will the Sage II, primed with p-code, stay at the front in the home straight, or will the new model from the old firm of IBM steal victory? Read on . . .

Breathless readers should by now have realised that the time has come round again for the great *APC* Benchmarks Round-up. Ever since the magazine started back in May 1980, we've been testing machines with a set of Basic programs designed to measure the speed at which they execute certain important routines. For this issue we've compiled the results, taken the averages for each machine and listed them in order.

As we've sorted the results according to this average speed, we've had to ignore machines for which we haven't got a complete set of timings. This time we've also omitted some of the systems which are no longer being sold, but compensation figures are included for the Macintosh whose Basic wasn't available when the machine was Benchtested in April '84 (for more on Mac Basic see next month's issue).

To answer the opening question, the Sage II has held off all-comers to top the list. Last year's winner, Olivetti's M20, is no longer listed, being replaced by its new brother the M24. IBM's PC AT, with a late burst on Benchmark eight, comes in second, closely pursued by the M24, a PC clone. The PC itself comes in lower, but is the highest placed machine reviewed in 1981 which is still on the list.

In case you're wondering, the B beside all these systems stands for business. Among the portables (Ps) Hewlett Packard is in front with its HP110, followed a fair way behind by the Data General One. Depending on how you define the home market (the Hs), the BBC B leads that particular part of the field, hotly pursued by the Amstrad CPC 464.

Nineteen eighty-four saw the demise of the 8-bit micro in the business market. The rush towards IBM compatibility has meant that the majority of new business machines are 16-bit and faster than their 8-bit rivals.

But home micros still stick with 8-bit technology. The only major exception to this is the Sinclair QL which uses the Motorola 68008 8/16/32-bit central processor. However, despite having a theoretical processing advantage over its home rivals, SuperBasic as tested was very slow and the QL only managed 18th place behind machines like the Memotech and the BBC B.

The fastest machine — the Sage II uses the Motorola MC68000 processor and runs a compiled version of Basic. The combination of a fast processor and compiled code singles it out as being different from the rest. The IBM PC AT, using the new Intel 80286 central processor chip, made a brave attempt to beat it, but expect to see both the top machines defeated this year as more machines adopt the Intel 80286 or the very fast 12MHz versions of the Motorola MC68000.

Although the Apple Macintosh uses the same Motorola MC68000 processor as the Sage II, it only came in at seventh place. This is mainly because we used an early pre-release version of MacBasic which was very bad at maths. Hopefully, later versions will be able to add up faster.

Looking at the top twenty positions, 1984 was obviously a good year for speed with 4 new machines listed. But before getting carried away with the idea of hurtling around the silicon at speed, a note of caution has to be struck. The figures may be interesting, but they don't make a good basis for deciding which machine to buy. At the very least you have to consider which Benchmarks are most appropriate to the kind of programs you want to run: for example, do your programs make heavy use of arithmetic operations or array access? And none of the Benchmarks calculates operations such as string handling, graphics or input/output.

What the Benchmarks do cover can be seen from the accompanying programs (each routine is repeated 1000 times to allow timing with a stop-watch). BM1 tests an empty FOR . . . NEXT loop. The other Benchmarks, with the exception of BM8, proceed by adding extra functions to the basic routine: BMs 3 and 4 show the difference between using constants and variables in the same formula; BM5 adds a GOSUB routine, so you can see how GOSUBs slow you down; BM6 DIMensions an array; and BM7 writes data into that array. Finally, BM8 tests the machine's maths and trig functions.

One irregularity affecting BM8 should be mentioned. To save a Benchtester time, this Benchmark originally tested only 100 loops instead of 1000. Where necessary, these figures have been multiplied by 10 to give them the same weight as the others when calculating the averages. Since the beginning of 1983, however, Benchtesters have had to curb their patience until all the 1000 loops have been completed.

Much to the irritation of its opponents, Basic remains the most important microcomputer language. We already have tests for Pascal and Forth, and we'd be interested in any proposals readers have for other languages. Given Basic's stranglehold on the market, though, it looks as though the Basic Benchmarks will continue to serve their (limited) purpose.

Benchmarks

```
100 REM Benchmark 1
110 PRINT "S"
120 FOR K= 1 TO 1000
130 NEXT K
140 PRINT "E"
150 END

100 REM Benchmark 2
110 PRINT "S"
120 K=0
130 K=K+1
140 IF K<1000 THEN 130
150 PRINT "E"
160 END

100 REM Benchmark 3
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/K*K+K-K
150 IF K<1000 THEN 130
160 PRINT "E"
170 END

100 REM Benchmark 4
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 K<1000 THEN 130
160 PRINT "E"
170 END

100 REM Benchmark 5
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 GOSUB 190
160 IF K<1000 THEN 130
170 PRINT "E"
180 END
190 RETURN

100 REM Benchmark 6
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB220
170 FORL=1 TO 5
180 NEXTL
190 IF K<1000 THEN 140
200 PRINT "E"
210 END
220 RETURN

100 REM Benchmark 7
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 230
170 FOR L=1 TO 5
180 M(L)=A
190 NEXTL
200 If K<1000 THEN 140
210 PRINT "E"
220 END
230 RETURN

100 REM Benchmark 8
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K^2
150 B=LOG(K)
160 C=SIN(K)
170 IF K<1000 THEN 130
180 PRINT "E"
190 END
```

CAT	Machine	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Average
B	Sage II (p-code)	.50	.70	1.30	1.70	2.10	5.10	6.40	18.00	4.47
B	IBM AT	.80	2.20	4.90	5.10	5.60	9.40	15.00	13.90	7.11
B	Olivetti M24	.80	2.50	5.20	5.20	5.70	10.00	15.30	16.60	7.66
B	Xerox 16/8	1.20	3.60	7.40	7.70	8.70	16.00	4.70	24.70	9.25
P	HP 110	0.65	3.40	6.60	6.80	7.70	14.20	21.80	21.90	10.38
H/B	Challenger	1.10	3.50	7.50	7.60	8.30	14.90	23.20	26.10	11.53
B	Apple Macintosh	.24	.65	6.00	6.40	7.10	8.60	15.90	52.30	12.15
B	HP 150	1.40	4.30	8.70	7.50	10.30	18.40	28.10	26.70	13.18
B	Commodore 720	1.10	6.50	12.00	12.30	14.20	22.10	35.30	7.20	13.84
B	TI Professional	1.00	4.20	9.30	9.70	10.50	19.00	29.50	31.00	14.28
H	Acorn BBC B	1.00	3.10	8.20	8.70	9.10	13.90	21.40	51.00	14.55
H	Amstrad CPC-464	1.09	3.28	9.16	9.61	10.20	19.03	30.18	34.20	14.59
B	Sirius 1	1.80	5.30	10.70	11.10	12.90	24.20	37.10	27.90	16.38
B	Apricot	1.60	5.20	10.60	11.00	12.40	22.90	35.40	34.40	16.69
B	IBM PC	1.50	5.20	12.10	12.60	13.60	23.50	37.40	35.00	17.61
P	Data General One	1.6	5.4	12.9	12.3	13.8	25.2	39.5	39.1	18.72
H	Memotech RS128	1.90	5.30	11.70	11.40	13.30	22.60	40.80	43.70	18.84
B	Apricot F1	2.00	6.00	12.20	12.50	14.10	25.80	39.80	38.60	18.88
H	Sinclair QL	2.10	6.40	10.70	10.30	13.20	26.10	61.80	25.80	19.55
B	NEC APC	2.30	2.30	13.70	17.60	17.80	32.00	34.80	37.10	19.7
B	Osborne 01	1.40	4.40	11.70	11.60	12.30	21.90	34.90	61.00	19.9
B	Tandy TRS-80	1.00	5.00	13.00	13.00	14.00	23.00	35.00	60.00	20.5
H	Sharp MZ-700	.40	3.40	9.50	8.60	9.40	17.70	32.70	82.70	20.55
P	Osborne Encore	1.90	6.60	14.20	14.60	15.80	28.30	44.00	47.80	21.65
H	IBM PC Junior	1.90	6.40	11.20	15.00	16.50	29.30	46.60	47.40	21.79
B	Superbrain	1.60	5.20	14.00	13.90	14.80	26.30	43.20	56.00	21.88
B	Apple III	1.70	7.20	13.50	14.50	16.00	27.00	42.50	75.00	24.68
P	Sharp PC-5000	1.98	5.82	15.80	16.90	19.10	33.00	55.40	52.20	25.03
B	Epson QX-10	2.30	6.40	15.80	15.80	16.50	31.90	52.90	65.80	25.93
B	Xerox 820	1.70	5.50	15.50	15.10	16.20	28.90	46.10	80.00	26.13
H	Commodore VIC 20	1.40	8.30	15.50	17.10	18.30	27.20	42.70	99.00	28.69
P	NEC 8201A	2.6	6.7	17.3	17.3	18.5	30.6	46.9	98.00	29.74
H/B	Apple II	1.30	8.50	16.00	17.80	19.10	28.60	44.80	107.00	30.39
H	Commodore Plus/4	2.00	9.80	18.20	18.70	18.80	34.80	55.30	101.10	32.34
P	Epson PX-8	3.00	8.00	19.50	19.00	22.50	40.00	62.50	89.00	32.94
B/H	MicroBee	2.7	10.0	18.1	17.9	20.9	39.4	67.3	95(est)	33.9
B	Sharp MZ-5600	1.50	7.20	19.80	20.20	21.60	32.80	53.80	115.20	34.01
H	CBM 8032	1.70	10.00	18.40	20.30	21.90	32.40	51.00	119.00	34.34
H	Micro-Professor	2.8	11.0	19.5	21.3	25.0	40.2	61.5	110.6	36.5
H	Sony HB-75	2.10	6.00	16.80	18.30	19.30	31.20	44.80	216.30	44.35
H	Spectra Video SV-328	2.30	5.70	18.20	20.00	20.90	32.80	45.10	235.70	47.59
H	Sinclair XZ-81	4.50	6.90	16.40	15.80	18.60	49.70	68.50	229.00	51.18
P	Epson HX-20	2.70	15.30	33.10	32.80	35.30	59.10	100.60	133.30	51.53
H	ZX Spectrum	4.80	8.70	21.10	20.40	24.00	55.30	80.70	253.00	58.5
P	Tandy Model 100	3.50	9.50	26.50	29.50	31.50	43.00	64.00	321.00	66.06
H	Atari 400/800	2.30	7.40	19.90	23.20	26.80	40.70	61.50	431.00	76.6
H	Texas TI99/4A	3.00	9.00	24.00	24.80	26.20	61.90	84.60	384.00	77.19
B/H	Canon X-07	3.9	11.5	32.0	35.8	38.1	58.3	78.9	379.6	79.76
P	Casio PB-100	8.00	39.00	82.00	80.00	105.00	160.00	220.00	341.00	129.4
P	Sharp PC1500	15.00	70.00	121.00	122.00	178.00	293.00	383.00	510.00	211.5

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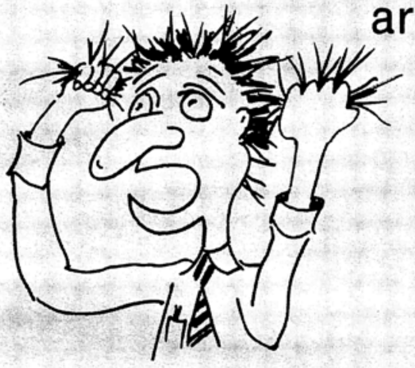

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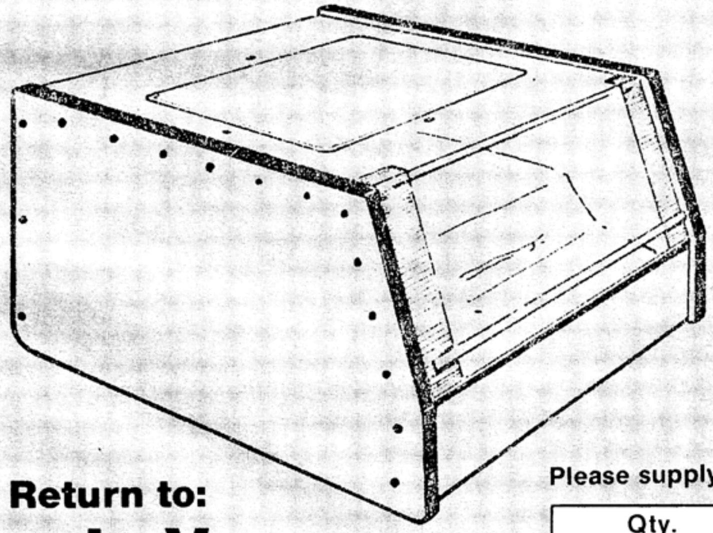

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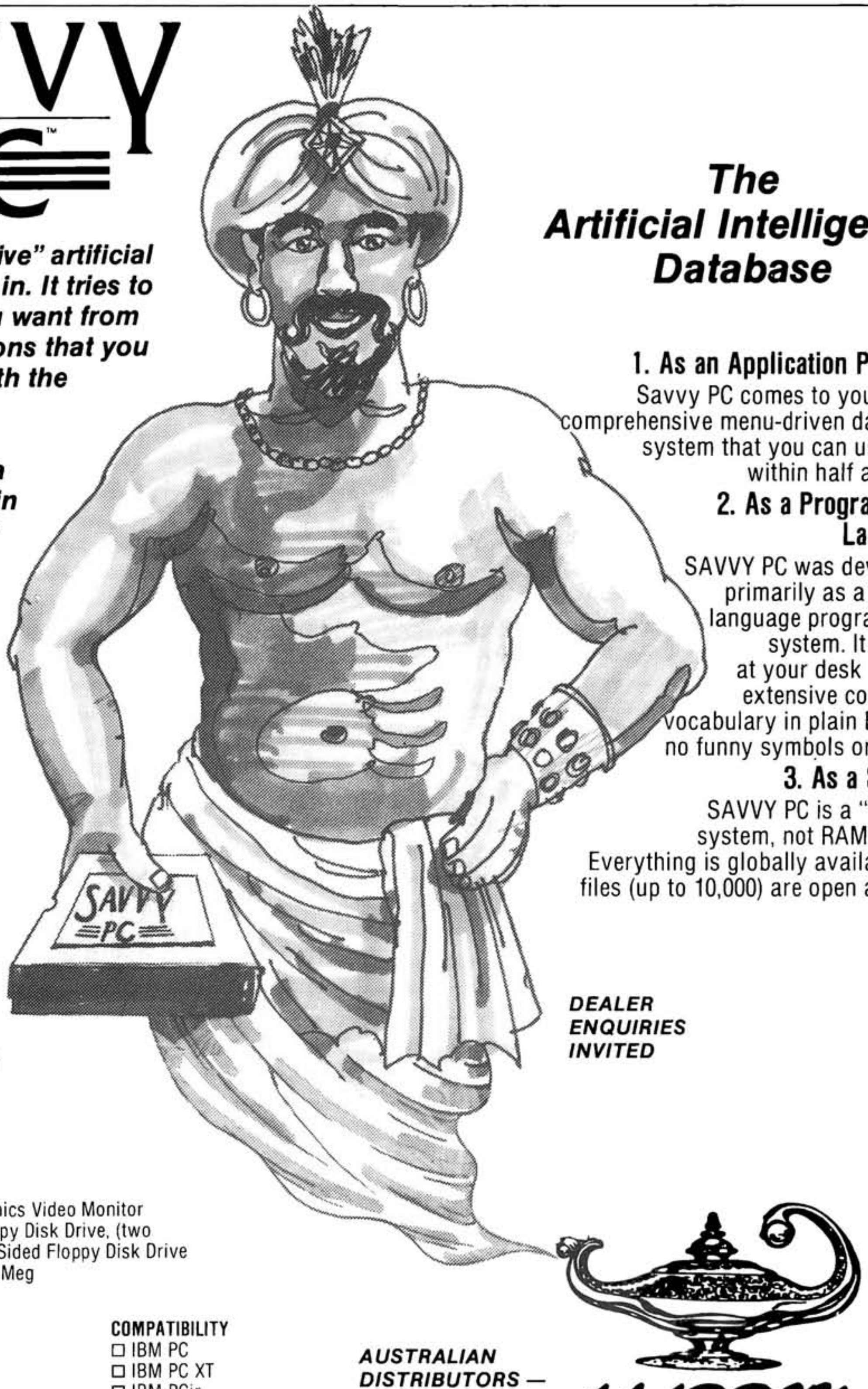

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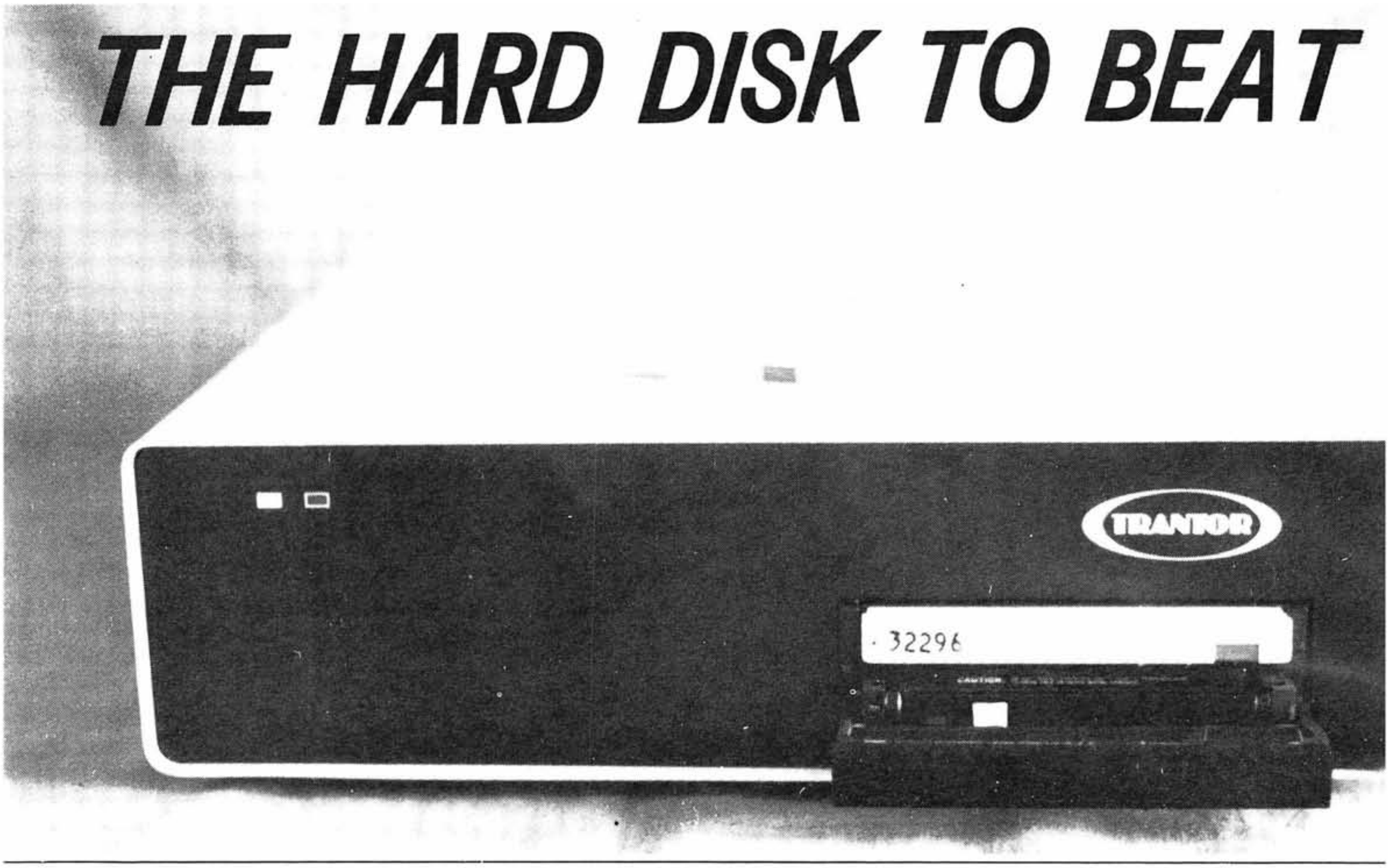

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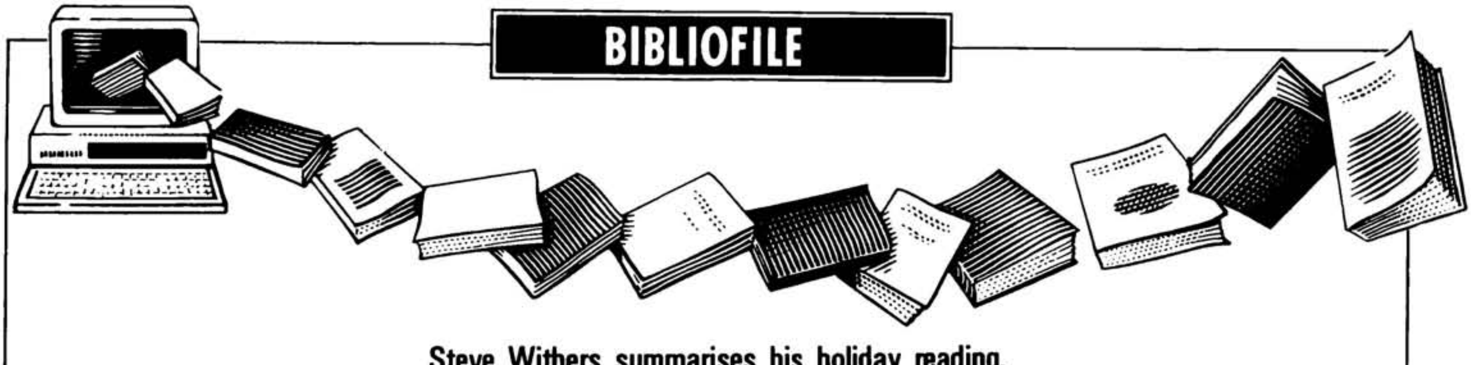


Steve Withers summarises his holiday reading.

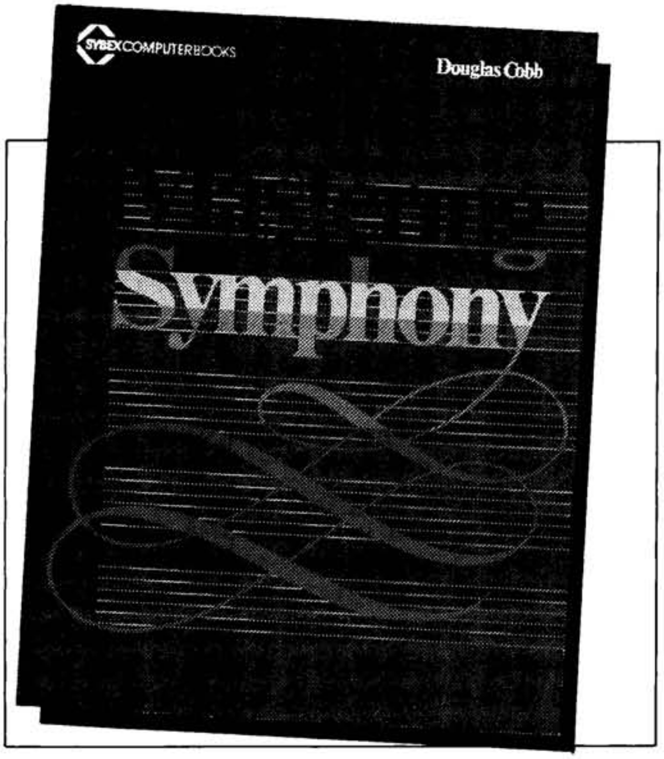
Mastering Symphony

Douglas Cobb must have spent many late nights working on this book as it was completed by August 1984 — not very long after the release of Symphony. It's a large book with over 750 pages, and it doesn't appear to have been just thrown together to cash in on the early interest in a new program.

I'm always worried about books that describe a particular product — are they intended for an audience that has already purchased, or one made up of people who have heard about the program or machine and want to find out more? The answer to this question has a major bearing on the material I expect an author to include or omit from a particular book. There is no doubt in my mind that Cobb's intention (more accurately 'the Cobbs' intention', as Steven and Gina Cobb played a major part in the preparation of the book) was to produce a tutorial for Symphony owners. Apart from anything else, it is explicitly stated in chapter one!

Having established that we are talking about a tutorial the next question concerns how much knowledge an author expects of his or her readers. Cobb's assumptions seem inconsistent to me. Unlike some writers, he expects his audience to be able to boot up their computers and run programs, yet he considers it necessary to write "To copy the disks, you must first format six blank disks using the DOS Format command. Next, use the DOS Diskcopy command to make copies of the original disks". While we can do without things like "plug in your computer and set the power switch (see figure one) to the '1' position", I think it would be better to either say "make backup copies of the six disks", or give step-by-step instructions about copying. A minor quibble, but it applies to the whole chapter on getting started. The section on configuring the program is even worse. For example: "Symphony offers 14 text and graphic display options . . . From this list, select the display option that matches your hardware configuration most closely". Yuck! I admit that I haven't used Symphony, but I have installed 1-2-3 and Lotus' instructions were clear enough. Basically, Cobb has tried to make the book too self-contained and it has suffered as a result. It would have been better with references to the DOS and Symphony manuals where appropriate, but this criticism applies to what is, after all, a small section of a large book.

It's much harder to criticise the rest of the book, as it gives a methodical tour of Symphony's functions and features. Very little is expected of the reader other than the basic idea of a spreadsheet, word processor, etc. It would take some time to work through all the examples, but by the end most readers would have gained a good working knowledge of one of the most sophisticated pieces of microcomputer software on the market.



One final complaint, this time aimed at Sybex, the publishers of the book — someone went to a lot of trouble to prepare what seems to be a comprehensive index, so why do you insist on hiding it behind adverts for your other books?

Mastering Symphony

Author: Douglas Cobb
Publisher: Sybex
Price: $49.95

Beginning Forth

There is no universally appropriate style for writing tutorials. Some readers appreciate a chatty, joking approach, others prefer a serious and straightforward book. My limited knowledge of Forth programmers suggests that the latter would be more appropriate for a book on that language, and so it is with Paul Chirlian's offering. His style may also be influenced by the fact that he is a Professor of Electrical Engineering and Computer Science, but this is not a turgid textbook.

If you are looking for a business-like tutorial then 'Beginning Forth' deserves closer examination, although potential buyers should be aware that it is biased towards MMS Forth, a dialect of Forth-79 that I believe is available for some of Tandy's microcomputers. Sentences like "this command is not part of Forth-79, but it is implemented in MMS Forth and in other Forth systems" appear quite often in the book.

Another problem with the content is that Chirlian concen-

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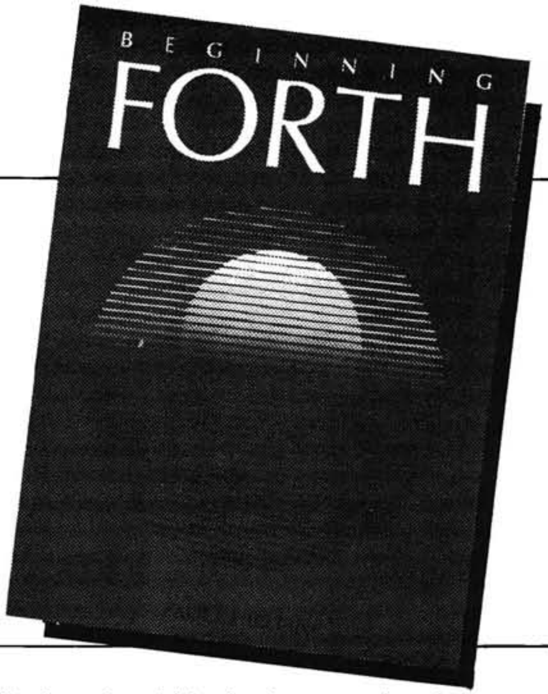
trates on arithmetical and mathematical examples, such as the calculation of Pythagorean triples! That isn't really representative of the examples though, as most of them are really program fragments (single Forth words) that perform fairly simple operations such as the Forth equivalent of

```
10  IF A=B THEN PRINT "NUMBERS ARE EQUAL":
    GOTO 30
20  PRINT "DIFFERENCE IS" A-B
30  END
```

The only example that really deserves to be described as a program is the one that illustrates string manipulation by reading in a list of names then printing in alphabetical order.

Despite remarks in the preface and blurb I'm not convinced that "Beginning Forth" is suitable for readers with no programming experience. This is because (in common with many other books) it is much stronger on the "how" than the "why". This is particularly noticeable in the chapter on control statements — it can help you if you know that the DO... LOOP type of loop (equivalent to FOR... NEXT in Basic) is the kind you need, but it does nothing to explain when it should be used in preference to BEGIN... UNTIL like Pascal's REPEAT... UNTIL). This is particularly serious as Chirlian points out that it is possible to conditionally jump out of a DO... LOOP before he presents the other kinds of loop. In the same chapter there is a short section on structured programming and Forth — this is a worthwhile inclusion even though it cannot make up for the shortcomings of the chapter.

To summarise, "Beginning Forth" is OK for programmers interested in using Forth for conventional applications, but no mention is made of control and the other real-time applications in which the language has been used so successfully.

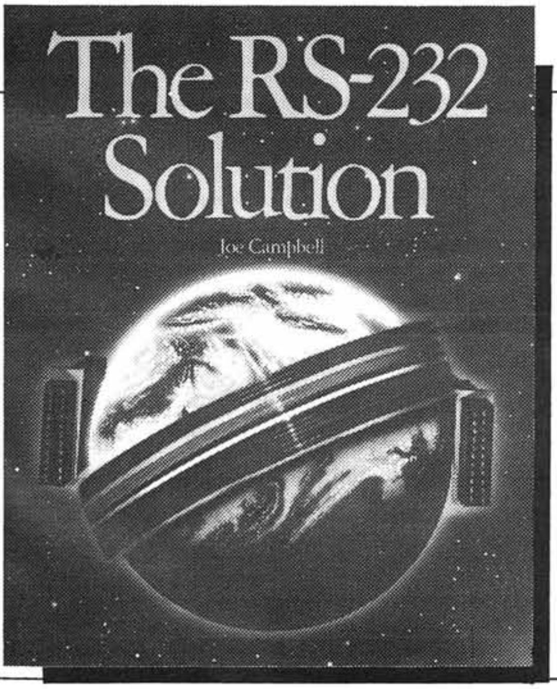


Beginning Forth

Author: Paul Chirlian
Publisher: Matrix Publishers, Inc
Price: $32.95

The RS-232 Solution

When I told someone about this book, his reaction was "How can you write a whole book about RS-232?" A good question. In fact, Joe Campbell has written a book that explains how to cope with devices that are supposed to conform to RS-232, but don't. After all, if all 'RS-232' interfaces really were what they claimed to be, the only problems would be in connecting two devices of the same gender — two dte's (speaking loosely, a dte is a device that 'looks like' a terminal) or two dce's (similarly, a dce 'looks like' a modem). More formally, a dce stands for 'data communications equipment', while dte means 'data terminal equipment'. Anyway, Campbell's point is that everything was fine while RS-232 interfaces were used to connect terminals to modems, but problems arise from the compromises and variations necessary to adapt it to a variety of different situations.



Adopting a policy of first things first — always sensible — he starts by establishing what serial communications is about, and how much can be read into a claim of 'RS-232 compatibility'. Then it's down to work with the 'interfacer's toolkit': a small collection of test clips, cables, and adaptors. Apart from the introductory material, most of the (very practical) information is presented in case study form. The cases involve a wide variety of equipment to illustrate a range of problems that can occur when interfacing. The items used are — in the main — popular things like Epson and OK Microline printers and Kaypro, Osborne and IBM computers, so much of the information is likely to be of direct use and not simply illustrative.

One of the best things about the book is that it presents a systematic approach to the problem of interfacing partially incompatible equipment, while there is no guarantee that you will "get it right the first time".

There's not a lot more I can say about this book, except to mention that it has proved useful on several occasions since it arrived for review. Oh, there was one other thing — the elephant cartoons are delightful!

The RS-232 Solution

Author: Joe Campbell
Publisher: Sybex
Price: $32.95

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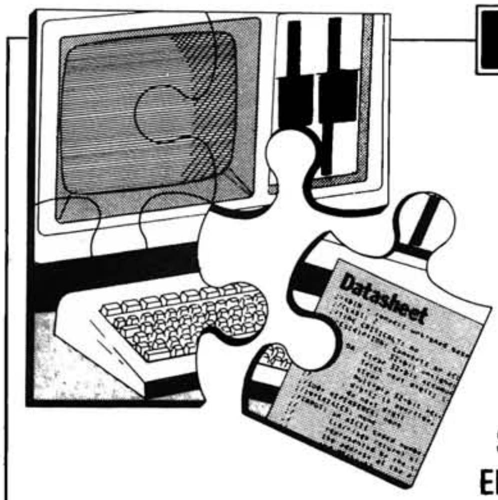

SUBSET

David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for.

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32-bit random

RNDL (Datasheet 1) from Matthew Rhodes implements SubSet's favourite 32-bit pseudo-random number algorithm on the 68000 series computers. His routine to generate a 16-bit random number, RNDW, was given last month. Both RNDW and RNDL are untested as yet.

RNDL is written to use the short addressing mode, which covers memory in the range $FF8000 to $007FFF. Only 'a1a0' is required in this mode, the high order bit being sign extended.

For a 'SEED' outside the short address range, change the coding of the first instruction to $2039 a3a2 a1a0, and of the instruction before RTS to $23C0 a3a2 a1a0. This makes the routine four bytes longer with an increase in operating time (clock cycles) to: 212 (68000), 308 (68008) i 178 (68010).

Descriptive reference to any combinations of the four bytes in a 68000 register is by a binary coding of their position expressed as a hexadecimal digit. Thus D1 \ C refers to the two highest bytes, and D1 \ 3 the lowest two bytes, in data register 1.

DATASHEET 1

```
;==============================================================
;= RNDL         32-bit pseudo-random number generator.
;==============================================================
;JOB            To generate a 32-bit random number from the
;               series: Ri+1 = (Ri * 69069 + 41) mod 2**32.
;ACTION         Read previous random number from store.
;               Acting separately on HI-word and LO-word and
;               using the identity, 69069 = 65536 + 3533,
;               new number =
;                 ((3533 * HI + LO) mod 2**16) * 65536
;                 + 41 + LO * 3533.
;               Write new random number to number store.
;--------------------------------------------------------------
;CPU            MC68000 series.
;HARDWARE       Four bytes of RAM for random variable, must be
;               located between $FF8000 to $007FFF inclusive.
;SOFTWARE       None.
;--------------------------------------------------------------
;INPUT          32-bit seed or previous random number must be in
;               RAM variable SEED.
;OUTPUT         New random number in SEED.
:               D0 = new random number. D1 is changed.
;               Negative (N) and Zero (Z) flags show the status.
:               Overflow (V) and Carry (C) flags are cleared.
;ERRORS         Re-entrancy could cause numbers in the sequence
:               to be missed, affecting the randomness.
;REG USE        D0 D1 CCR
;STACK USE      None.
;RAM USE        None.
;LENGTH         32
;CYCLES         68000: 204.  68008: 292.  68010: Max. 170.
;--------------------------------------------------------------
;CLASS 2        -discreet  *interruptable  *promable
;-**-*-         -reentrant  *relocatable  -robust
;==============================================================
```

```
;
SEED    EQU      $a1a0     ;Address of 4-byte random number.
;
RNDWAS MOVE.L   SEED,D0   ;Get old number or seed into     2038
                           ;Data register 0 and             a1a0
        MOVE.L   D0,D1     ;copy into D1.                   2200
        SWAP     D1        ;Move HI-word to D1\3 and        4841
        MULS     #3533,D1  ;multiply by 3533; D1\F =        C3FC
                           ;D1\3 * $DCD, then add in        0DCD
        ADD.W    D0,D1     ;LO-word and multiply by 65536;  D240
        SWAP     D1        ;D1\C = (D1\3 + LO) * $10000.    4841
        MOVE.W   #41,D1    ;Put constant in D1\3 for        323C
                           ;adding in to D0.                0029
        MULS     #3533,D0  ;Multiply LO-word by 3533;       C1FC
                           ;D0\F = D0\3 * $DCD.             0DCD
        ADD.L    D1,D0     ;Combine parts then store        D081
        MOVE.L   D0,SEED   ;new number (mod 2**32 since     21C0
                           ;D0 is 32 bits) back to          a1a0
        RTS                :variable and exit.              4E75
;==============================================================
```

6809 error detection

ECAL9 (Datasheet 2) and EFIX9 (Datasheet 3) from Martin Chadwick are conversions to 6809 code from the original Z80 versions (December 1982, *APC*). 6502 versions were published in January 1983.

ECAL9 forms an error correction byte (ecb) by parity coding the position of every bit on a 31-byte data block. The ecb can be appended for transmission or storage of the data.

On receipt or recovery of the data, EFIX9 tests the appended ECB against that recalculated for the received data. Any set bits in the resultant error correction code are used to index and re-invert any single bit error that may have occurred.

DATASHEET 2

```
;==============================================================
;= ECAL9        Calculate error correction byte.
;==============================================================
;JOB            To calculate a single byte parity code, capable
;               of being used to detect and correct a single bit
;               error in a 1 to 31 byte data block.
;ACTION         IF block byte length > 0 AND < 32 THEN:
;               [ Parity mask bit count = bytes * 8 + 7.
;                 Clear error correction byte (ecb).
;                 WHILE bit count > 7:
;                 [ IF current bit = 1 THEN:
;                   [ ecb = ecb EOR bit count. ]
;                   Bit count = bit count - 1. ] ]
;--------------------------------------------------------------
;CPU            6809
;HARDWARE       Memory containing data block.
;SOFTWARE       None.
;--------------------------------------------------------------
;INPUT          Y addresses first byte of the data block.
```

```
;          B = no. of bytes in data block (max. 31).
;OUTPUT    Cy = 0; aborted. B = 0 or B > 31. A,Y unchanged.
;          Cy = 1; A = ecb. Y = block + 1. B = 7.
;ERRORS    None.
;REG USE   CC A B Y
;STACK USE 1
;RAM USE   None.
;LENGTH    34
;CYCLES    40 + average 145 per byte.
;-------------------------------------------------------------
;CLASS 2   -discreet  *interruptable  *promable
;-*****    *reentrant  *relocatable  *robust
;=============================================================
;
ECAL9   PSHS B       ;Save block length and test          34 04
        DECB         ;for valid length 1 to 31,           5A
        CMPB #30     ;exiting immediately if 0 or         C1 1E
        BHI  ECOUT   ;greater than 31 with C = 0.         22 19

        LDA  #8      ;Multiply length - 1 by bits per     86 08
        MUL          ;byte, then add by subtraction so    3D
        SUBB #-15    ;B = no. of bits + 7 & C = 1.        C0 F1
        STB  ,S      ;Save parity mask bit count.         E7 E4
;
BYTELP  LDB  ,Y+     ;Get indexed byte, index next.       E6 A0
        ROLB         ;Move 1st bit out to C. Move 1 in.   59
;
BITLP   BCC  NXTMSK  ;"ecb EOR 0" if bit reset, else      24 02
        EORA ,S      ;"ecb EOR bit count".                A8 E4
NXTMSK  DEC  ,S      ;Count off bit processed, move next  6A E4
        LSLB         ;data bit out, and repeat until      58
        BNE  BITLP   ;Carry = initial Carry = 1.          26 F7
;
        LDB  #$F8    ;Test if parity mask bit count is    C6 F8
        BITB ,S      ;less than 8, repeating until it     E5 E4
        BNE  BYTELP  ;is, when all bits done. C = 1.      26 EE
;
ECOUT   PULS B,PC    ;Exit, C = 0 = invalid, else C = 1.  35 84
;=============================================================
```

DATASHEET 3

```
;=============================================================
;= EFIX9   Validate data with error correction byte.
;=============================================================
;JOB       To examine a 1 to 31 byte data block with
;          appended error correction byte, correcting any
;          single bit inversion indicated.
;ACTION    IF block byte length > 0 AND < 32 THEN;
;          [ Calculate new error correction byte (ecb).
;            Correction code = new ecb EOR appended ecb.
;            IF set bit(s) in correction code THEN;
;            [ IF correction code addresses data bit THEN;
;              [ Correct bit error by re-inversion. ] ] ]
;-------------------------------------------------------------
;CPU       6809
;HARDWARE  Memory containing data block.
;SOFTWARE  "ECAL9" - routine to calculate ecb, located
;          within single byte signed offset range.
;-------------------------------------------------------------
;INPUT     Y addresses first byte of the data block.
;          B = no. of data bytes in block (max. 31).
;OUTPUT    Cy = 0; aborted. B = 0 or B > 31. A,Y unchanged.
;          Cy = 1; Y = block + 1. B is unchanged.
;             Z = 0; Data assumed valid.
;             Z = 1; A single bit has been corrected.
;ERRORS    More than one real bit-error, or a bit error in
;          the error correction byte can result in an
;          uncorrupted bit being inverted.
;REG USE   CC B Y
;STACK USE 7 (including BSR ECAL9)
;RAM USE   None.
;LENGTH    36
;CYCLES    Average 123 + 145 per data byte.
;-------------------------------------------------------------
;CLASS 2   -discreet  *interruptable  *promable
;-****-    *reentrant  *relocatable  -robust
;=============================================================
;
EFIX9   PSHS A,B,X   ;Save regs. with length on top + 1.  34 16
        BSR  ECAL9   ;Get new ecb in A, Y addressing      8D nn
        BCC  EFOUT2  ;appended ecb, or skip if invalid.   24 1C
;
        EORA ,Y      ;Correction code = new ecb EOR       A8 A4
        TFR  A,B     ;appended ecb. Copy it to B          1F 89
        ANDB #$07    ;and get error bit number in B.      C4 07
        LSRA         ;Divide correction code              44
        LSRA         ;by 8 to give position of corrupt    44
        LSRA         ;byte from end of block in A.        44
        BEQ  EFOUT1  ;Exit if no error indicated.         27 10
        CMPA 1,S     ;Compare with block length and       A1 61
        BHI  EFOUT1  ;exit if indicated error outside.    22 0C
        NEGA         ;A = -A (set Cy), add to end         40
        LEAX A,Y     ;pointer, X addresses corrupt byte.  30 A6
        SEX          ;Clear A, (Cy unaffected).           1D
;
EBIT    ROLA         ;Rotate set bit from Carry into      49
        DECB         ;corrupt bit position, using bit     5A
        BPL  EBIT    ;number from correction code.        2A FC
;
        EORA ,X      ;Re-invert corrupt bit and           A8 84
        STA  ,X      ;restore correct data to byte.       A7 84
;
EFOUT1  COMB         ;C = 1 always, Z = 1 only if error.  53
EFOUT2  PULS D,X,PC  ;Restore and exit with flag info.    35 96
;=============================================================
```

68000 multiplication

The 68000 performs both signed and unsigned 16-bit multiplication. The first argument must be in the low word of a data register (Dn/3) and the second in any of 11 other source operands — the 'Effective Address', or 'ea'. The 32-bit result overwrites the first argument and also the high word in that register.

According to the *M68000 16/32-Bit Microprocessor Programmer's Reference Manual*, fourth edition, published by Prentice-Hall, the execution time of MULU and MULS is defined as a constant plus 2n where:

n=the number of set bits (1s) in the 'ea', (MULU).

n=the number of 10 or 01 patterns in the 'ea' extended to 17 bits by attaching a '0', (MULS).

For the 68008, the manual tags the 17th bit for the MULS algorithm as the most significant bit. It is tagged as the least significant bit for the 68000, probably in error.

Matthew Rhodes makes the point that, where speed is paramount, a few cycles can sometimes be gained by carefully selecting between MULU or MULS to match the bit pattern of the multiplier. This only applies when the most significant bit of the multiplier is zero, as it's in the value $0DCD in RANDL. Matthew reckons that using MULS instead of MULU saves two clock cycles.

Repetitive speed

Frank Golding has taken me to task for comparing the fill times of the Z80 instruction LDR with those of Roy Easto's routine QUKFLL (October 1984, *APC*).

He writes:

'. . . although QUKFLL is an absolutely brilliant idea it is only capable of filling a block of RAM with the fixed contents of HL. In this respect it is not a block transfer operation like LDIR or LDDR, both of which update the source and destination pointers on each operation! The comparison of 21 T states (clock cycles) for LDIR against about 6.3 T states for QUKFLL is pretty meaningless except in the quoted example, where presumably LDIR is used to transfer a "blank" screen onto a real screen, looping through several thousand blank bytes of separate memory in the process.'

QUKFLL doesn't set out to be a block transfer — only to fill a RAM area with one character more quickly than by using LDIR. For all of you who have not come across it, the block transfer method

Baby Grand courtesy R.H. Elvy P/L

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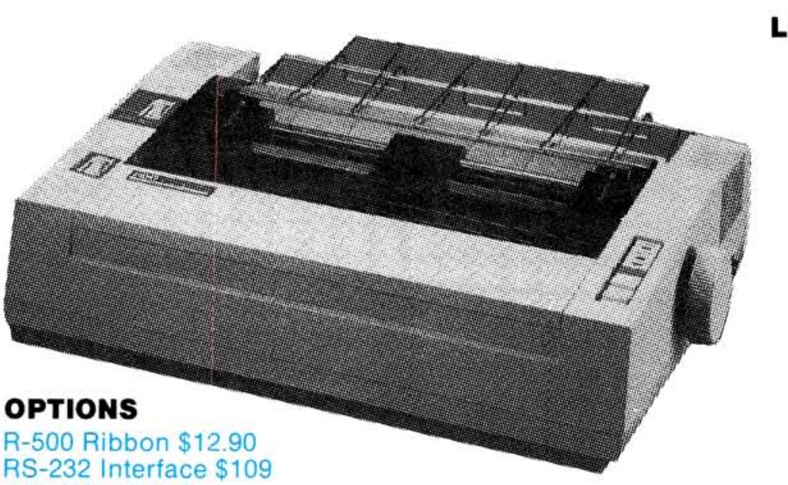

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LOGITEC FT-5002 FEATURES

Print Rate	120 cps (59 LPM)
Line Feed Speed	100 msec
Print Direction	Bi-directional with logic seeking
Input Buffer	1 KB
Character set	Standard Mode 96 ASCII characters with descenders 11 semi graphics, 8 international characters Italic characters IBM-PC Matrix Printer Mode 96 ASCII characters with descenders 64 block characters, 9 international characters. IBM-PC Graphic Printer Mode Additional ASCII contain European, Graphic, selected characters, math and extra symbols.
Font Registraction	Up to 40 characters
Character Structure	9 x 9
Character Size	Ordinary characters 1.99(W) x 2.24(H) mm Superscript/subscript characters 1.9(W) x 1.36(H) mm
Characters per line	Ordinary (pica/elite) 80/96 Double width elongated (pica/elite) 40/48 Compressed (pica/elite) 132/158 Compressed and elongated (pica/elite) 66/79 Superscript, subscript (pica/elite) 80/96
Paper Feed	Friction feed, Sprocket feed
Paper Width	Fanfold 4–10 inches Cut sheet 4–9 inches
Copies	3 max.
Interface	Standard Centronics-style 8 bit parallel Optional RS232C with 2K buffer (X/ON-X/OFF and ETX/ACK protocol)
Ink Ribbon	Cassette (Service life: 3 mil characters)
Head Service Life	Over 100 mil characters

100DP — FEATURES

Printing format	Alpha-numeric — 7 x 8in 8 x 9 dot matrix field. Semi-graphic (character graphic) — 8 x 8 dot matrix. Bit image graphic — Vertical 8 or 9 dots parallel. Horizontal 640 dots serial/line.
Character size	Normal size — 2.22(W)x2.8(H)mm=0.087"x0.11" Condensed size — 1.11(W)x2.8(H)mm=0.044"x0.11" Enlarged size — 4.44(W)x2.8(H)mm=0.175"x0.11" ELITE size — 1.8 (W)x2.8(H)mm=0.07" x0.11" Enlarged ELITE — 3.6(W)x2.8(H)mm=0.14"x0.11" Super/subscript — 2.22(W)x1.4(H)mm=0.087" x 0.0055" Semi-graphic unit — 2.54(W)x2.8(H)mm=0.1" x0.11".
Character sets	ASCII characters — 192 (96 normals and 06 italis). JIS characters — 160 (64 katakanas and 96 alphanumerics). Semi-graphic units — 103. International Specials — 2 for U.S.A., 1 for UK, 8 for German, 8 for French, 4 for Swedish, 2 for Italian, 6 for Spanish, 48 for Greek, 6 for Danish and 2 for Japan.
Printing Speed	100 C.P.S. for normal size print. 200ms for line feed.
Columns/line	Normal — 80 columns. Condensed — 142 columns. Enlarged — 40 columns. Condensed/double width — 71 columns. 'ELITE' — 96 columns. Enlarged 'ELITE' — 48 columns.
Printing direction	Text and semi-graphic — Bidirectional, logic seeking. (programmable) Super/subscript and bit image graphic — Unidirectional left to right.
Line spacing	6 L.P.I. — 4.23mm. 8 L.P.I. — 3.18mm. Programmable in increments of 0.35mm (1/72) and 0.118mm (1/216")
Paper feed	Adjustable sprocket feed and friction feed.
Paper type	Fanfold. Single sheet. Roll paper. Thickness — 0.05mm (0.002") to 0.25mm (0.01") Paper width — 101.6mm (4") to 254,, (10")
Number of copies	Original plus 2 copies by normal thickness paper.

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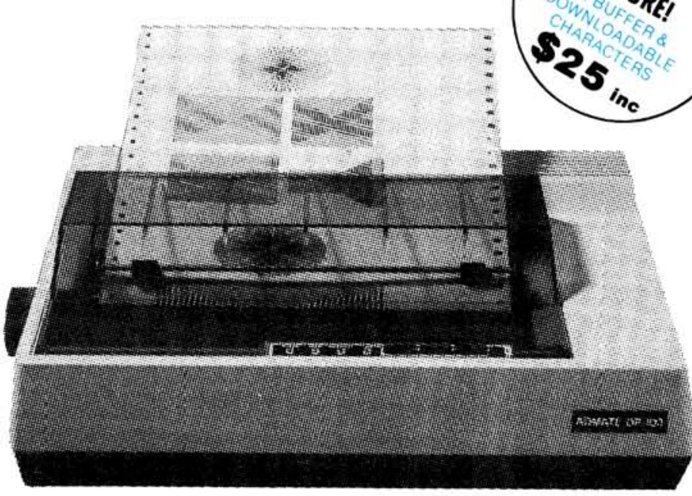

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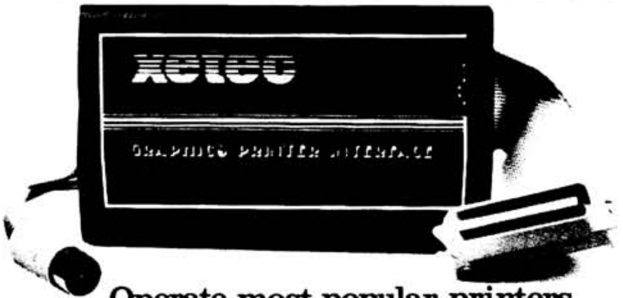

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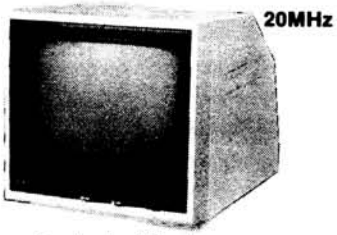

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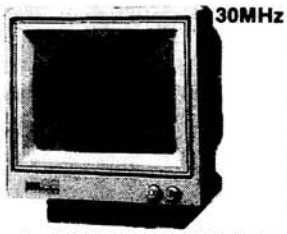

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of screen clearing is shown in Fig 1. Only screen memory, in this case that of the Exidy Sorcerer, is accessed by the method.

The same method is used to clear individual screen lines on the Spectrum (see page 47 of *The Complete Spectrum ROM Disassembly* by Dr Ian Logan and Dr Frank O'Hara published by Melbourne House).

```
START  EQU  0F080H       ;Start address of screen memory.
BYTES  EQU  780H         ;No. of screen memory bytes.
;
CLEAR  LD   HL,START     :Point HL to 1st byte,         21 80 F0
       LD   DE,START+1   ;DE to 2nd byte and give BC  11 81 F0
       LD   BC,BYTES-1   :no. of bytes to copy to.    01 7F 07
       LD   (HL),32      :Clear 1st byte and copy it  36 20
       LDIR              :to all other screen bytes.  ED B0
```

Fig 1

BBC Assembler formatting

S Karlsson, who sent LSTFMT, the marvellous listing formatter for BBC assembly language programs (November 1984, *APC*), has written to correct the mistake I made about locations &D00 and &D01 being set to &FF on machine reset. Only &D00 is affected this way.

There are, in fact, several pages below the Basic program area available for storing machine code routines — provided Basic isn't using them. The assignments for these pages are shown in Fig 2.

Probably the safest way to store a program like LSTFMT is to set the PAGE variable to &F00 (&1A00 for a disk machine) and change LSTFMT lines 50 and 180 to write the machine code to address &E00 (&1900). PAGE will need to be reset after every BREAK.

```
&800 - &8FF;   Sound.
&900 - &9FF;   Cassette and RS-423 output.
&A00 - &AFF;   Cassette and RS-423 input.
&B00 - &BFF;   Soft key expansion.
&C00 - &CFF;   Redefined characters.
&D00 - &DFF;   NMI routine and ROM expansion vectors.
```

Fig 2

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Project Mgmt	Pert, resource mgmnt, materials mgmnt, job control: modular	●	●	●	2550+
Builders	"Bash" builders accounting and costing package	●	●	●	2995
Compact	Complete suite of accounting: fully integrated drs, crs, gl, stk, orders	●	●	●	590 ea
Nucleus	Award winning database and report writer	●	●	●	990
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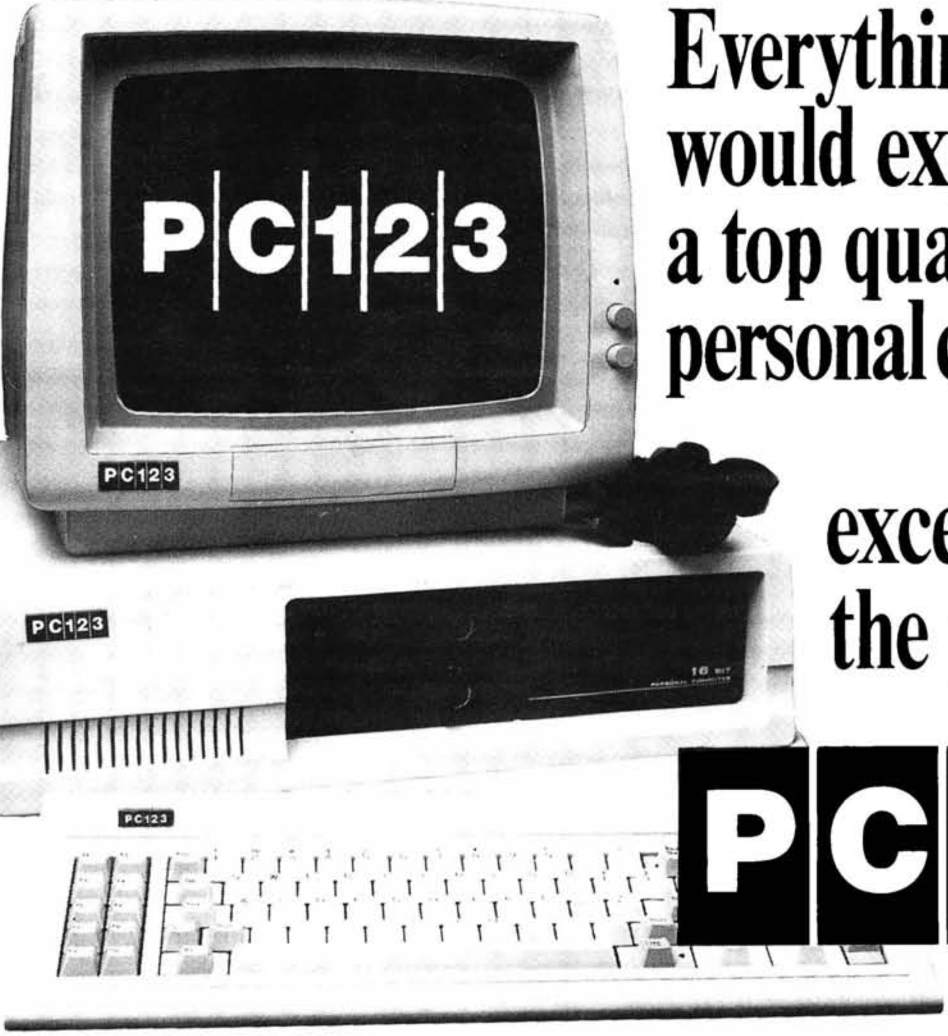

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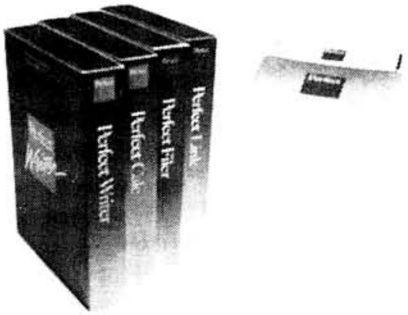

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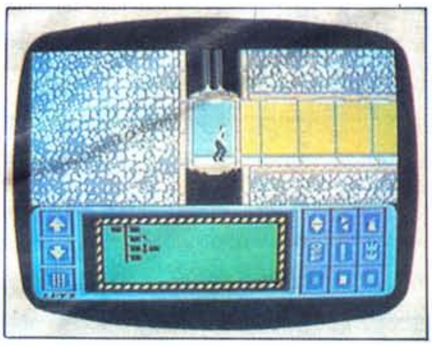
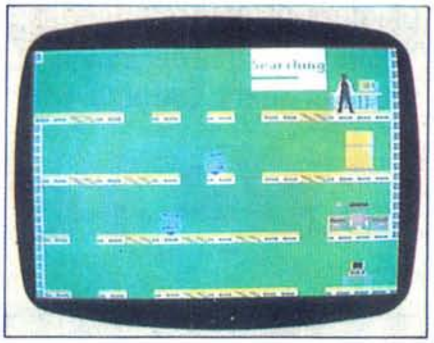
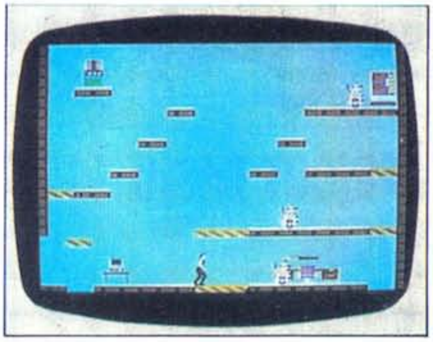
Tony Hetherington tries to foil an evil doctor's bid to destroy the world, becomes a Psi warrior, and joins the wacky races, all in this month's selection of games.







Nothing's impossible . . .

GAME: Impossible Mission
MACHINE: Commodore 64
SUPPLIER: CBS Electronics
PRICE: $29.95 disk; $19.95 cassette

'Another visitor . . . stay awhile . . . stay *forever*'. These are the game's opening words that not only set the scene, but the atmosphere too. Epyx has created a coherent software voice which also manages to sound wicked.

The voice belongs to the evil Dr Elvin whose bunker you have just entered. He has threatened the world with nuclear annihilation and it's your job to stop him. You are agent 4125 and, as you can guess, a few agents have been lost since 007: as you play the game you'll see where they went. You'll also see why this is the definitive platform game.

Your character is joystick controlled, and jumps and somersaults through 32 rooms. Each room consists of platforms, lifts, numerous objects to be searched and some anti-social robots.

Should you get past the human-seeking robots and reach an object (which can be anything including the kitchen sink), then you may search it. This is done by pushing your joystick up and waiting until the bar that appears is diminished; the length of this bar represents the time needed to search the object. When your search is completed you are told what you have found. This is usually nothing, but occasionally you unearth a piece of the puzzle that you must unravel in order to crack Dr Elvin's security and thereby foil his dastardly attempts to destroy the world.

Unfortunately the robots are a match for all but the best players as they cover your every move awaiting the chance to kill you, and their behaviour alters from one game to another. Routes through rooms aren't easy to discover, so the game keeps its appeal.

Software houses could learn a lot from *Impossible Mission* — in terms of quality it's streets ahead. The character animation and the robots are impressive, but the sound is outstanding: as you run along the corridors it sounds like footsteps on a metal floor. The lifts make realistic noises as do the robots, but the most impressive is the voice.

'Kill him, my robots!' is a disturbing greeting as you enter a room, as is the 'Aaaaaaaaargh!' when you plummet to your doom. Finally, should you fail in your mission, an evil laugh announces a report of your dismal performance.

Wacky races

GAME: Pitstop
MACHINE: Commodore 64
SUPPLIER: CBS Electronics
PRICE: $29.95 disk; $19.95 cassette

Pitstop challenges you to master six of the toughest race tracks in the world as you cut corners and burn up tyres in a bid to save those vital seconds.

It's a game for up to four people but unfortunately only one can race at a time, therefore each sets a time for the others to beat. The races are average, you weave your way in between the other cars, but the fun starts when you're in the pits.

On the track you have to keep an eye on your fuel and tyres; fuel is represented by a gauge, and tyre wear by a change in the tyres' colour. They start a comforting dark blue and gradually wear through green to red, then briefly turn yellow before bursting. They become damaged through collisions with other cars and reckless cornering, but if you slow down to save them you'll lose valuable time. The harder you drive the more fuel you use, but the less fuel you have the lighter and faster your car.

Such are the choices facing the driver in a race that can be won or lost by a fraction of a second.

Races are won and lost in the pits — if your team can put you back on the road ahead of the opposition, you'll have a winning advantage.

To be successful you must be fast in the pits. The screen display shows your team around the car, and you use your joystick to move the men who refuel your

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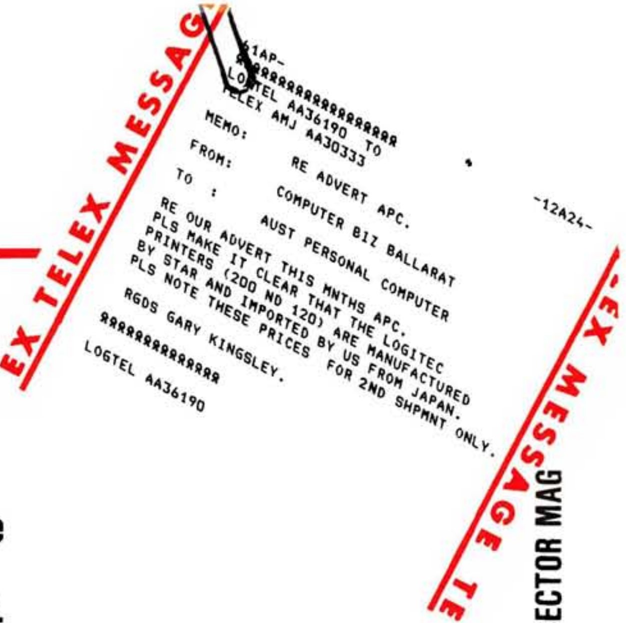
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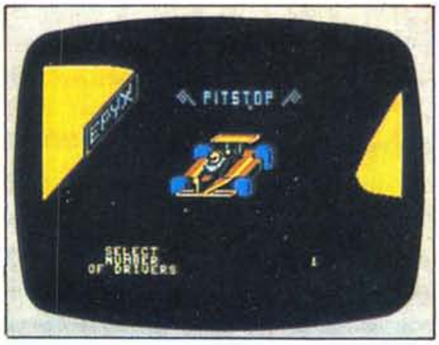
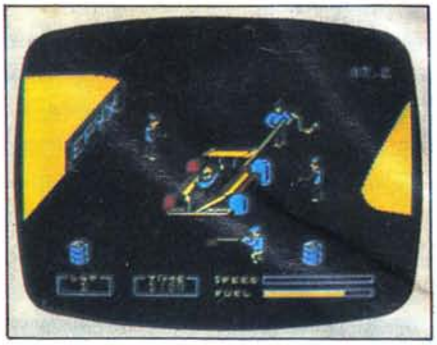
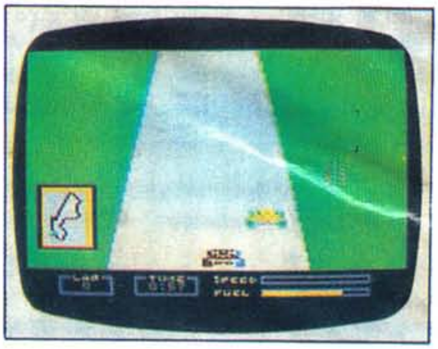




car and replace worn tyres.

You may decide to change one or two tyres, or perhaps only half-fill the fuel tank. Either way will save you seconds, but if the gamble fails you get nothing from the winning purse. After each race the purse is divided, and at the end of the three- or six-race series the player with the most money is the winner. Individual races can be either three, six or nine laps long, but six is best for gamblers.



Mind games

GAME: Psi Warrior
MACHINE: Commodore 64
SUPPLIER: International Software Distributors
PRICE: $29.95

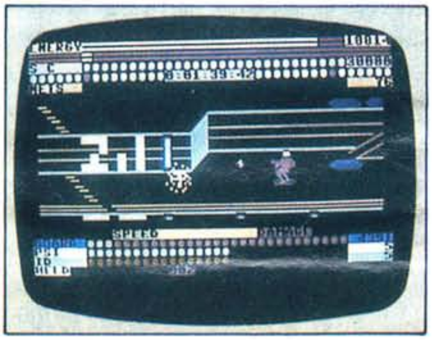
Psi Warrior is the follow-up by the company that produced the excellent *Psytron*, which is now available for the Commodore 64. There the similarity ends.

You are a Psi warrior whose mission is to destroy the strongest of the Psi creatures, the Source, which lurks in an ancient silo.

Unfortunately it lives 80 levels down and before you reach it you'll have to do battle with Psi, Ids and Pupae. The Psi are bred from the mental energy of human minds and the Ids from man's animal instinct. The Pupae are disembodied human entities which are yet to turn into Psi or Ids.

They don't attack you physically but drain your Psi and Id energy; this should be avoided, since you use your Id energy as fuel with your Psi energy to control it.

You can also use Psi energy to teleport and levitate yourself, as well as to make yourself temporarily invisible. You're armed with a Psi net gun and travel on a highly manoeuvreable hover board. The board is joystick controlled and although it's easy to use, you'll have to practise before you have sufficient skills to plunge into the depths of the silo.



Your Psi net gun fires nets which trap a Psi creature. You should be ready to move in close to drain its energy and perhaps even destroy it, but be wary — it may break free at any time.

The silo itself is a complex maze of 3D passages, teleport chambers, speed mats, slide ramps and recesses. Some of these gaps will be easily jumped, but others will require hard-earned and accurate skills.

It will take you a while to master this game's subtleties (for example, board control and the behaviour of the Psi creatures), so you can save your game position to either tape or disk.

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Please ensure that the software itself, the documentation and the listing are all marked with your name, address, program title, machine (along with any minimum requirements) and — if possible — a daytime phone number.

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Home computer owners often complain of a 'boring lull' about four weeks after purchasing a micro: they've typed in small Basic programs and played *ad infinitum* the few games they could afford after buying the machine. Typing in listings from a magazine can help fill this void as it provides a source of cheap software as well as a means of increasing Basic knowledge by modifying the typed-in software — alteration of a large program can give you necessary skills to start your own major project.

Considering that the vast majority of computer sales are at Christmas, a lot of people will be feeling at a loose end. This month's selection of programs is designed to keep you busy.

On the arcade side there is Meteor Attack for the Atari. From the board game side there is a truly excellent draughts program for the BBC.

Other programs this month are an MTX Old command, a TRS-80 machine code parser for inclusion in adventure games, a Commodore 64 screendump and a first class disk utility, also for the '64.

Games
Scientific/mathematic
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---

64 Disk Manager

by David Jones

Here is a collection of powerful disk utilities for the Commodore 64 and 1541 disk drive. The utilities are strung together in one package, very much like the Apple FID program or Atari DOS. Some of the options allow you to perform simple tasks (rename, validate, etc), but some perform functions that would otherwise be difficult, eg, restoring deleted files.

There are 11 main options excluding Q-uit manager. A, I and J are self-explanatory, and the following are the more exotic commands:

B — restores previously scratched files. It searches the disk for all scratched files, and if they can be retrieved, you are asked if you want to regenerate each file in turn. If one or more files has been reclaimed, the B option will validate the disk to fix the BAM (Block Availability Map) before exiting.

C — copies one or more files on a single disk system. It uses memory from $1000-$FFF for storing the file before copying it. This means it copies files of 96 blocks or less, although this limit can be altered by adjusting the buffer value in line 100. If *Disk Manager* is asked to copy a file when the file name already exists it asks for a new name, or gives you the option to skip that particular file.

D — scratches from the disk, but unlike the normal wildcard scratch it asks for permission before scratching each file.

E — is a useful option that displays the start/end addresses for PRG files, or just the exact file length for USR and SEQ files.

F — has four sub-options, and allows the user to format the whole disk, erase just the sub-directory, and test the disk surface for bad blocks.

G and H — are exact opposites, locking and unlocking disk files respectively. This is a little-known feature of the 1541 disk drive, and is normally difficult to implement. Locked files are displayed with a '<' next to the file type, eg, 'PRG<'. When a file has been locked any attempt to scratch it is ignored, although SAVE@ is still effective.

K — is almost a self-contained program. It is a simple block editor that allows the user to edit any disk block in either ASCII or Hex. When executed, the option displays the entire 256-byte block, and using the cursor allows the user to type over bytes. As with the Basic editor, Return must be pressed to fix the changes. To change the disk block the cursor must be positioned over the 'Write Block' phrase, and again return must be pressed. The Quit option works just the same.

When in Hex mode, inverse text mode is used to show where individual bytes start — apart from this visual aid it has no other function. In ASCII mode solid circles represent characters that cannot be displayed (non-ASCII codes). A hollow circle is used to show CHR$(160), which DOS V2.6 uses to pad out filenames — a useful character to be able to enter/display.

L — does three things: tidies up a disk directory; purges deleted files and sorts the directory alphabetically or by file type. The purge option erases all trace of previously deleted files from the directory — purged/sorted files cannot be recovered with utility B. The sort used is a crude bubblesort — more than adequate for an application like this.

How it works

Disk manager relies on the U1 and U2 disk commands for reading and writing sectors. Options B, G and H modify the file type marker (the first byte of a directory entry). This is set to zero when a file is deleted, and when ORed with 64 causes the file to be locked. The copy command merely treats PRG, SEQ and USR files as sequential files and reads them as just a string of characters.

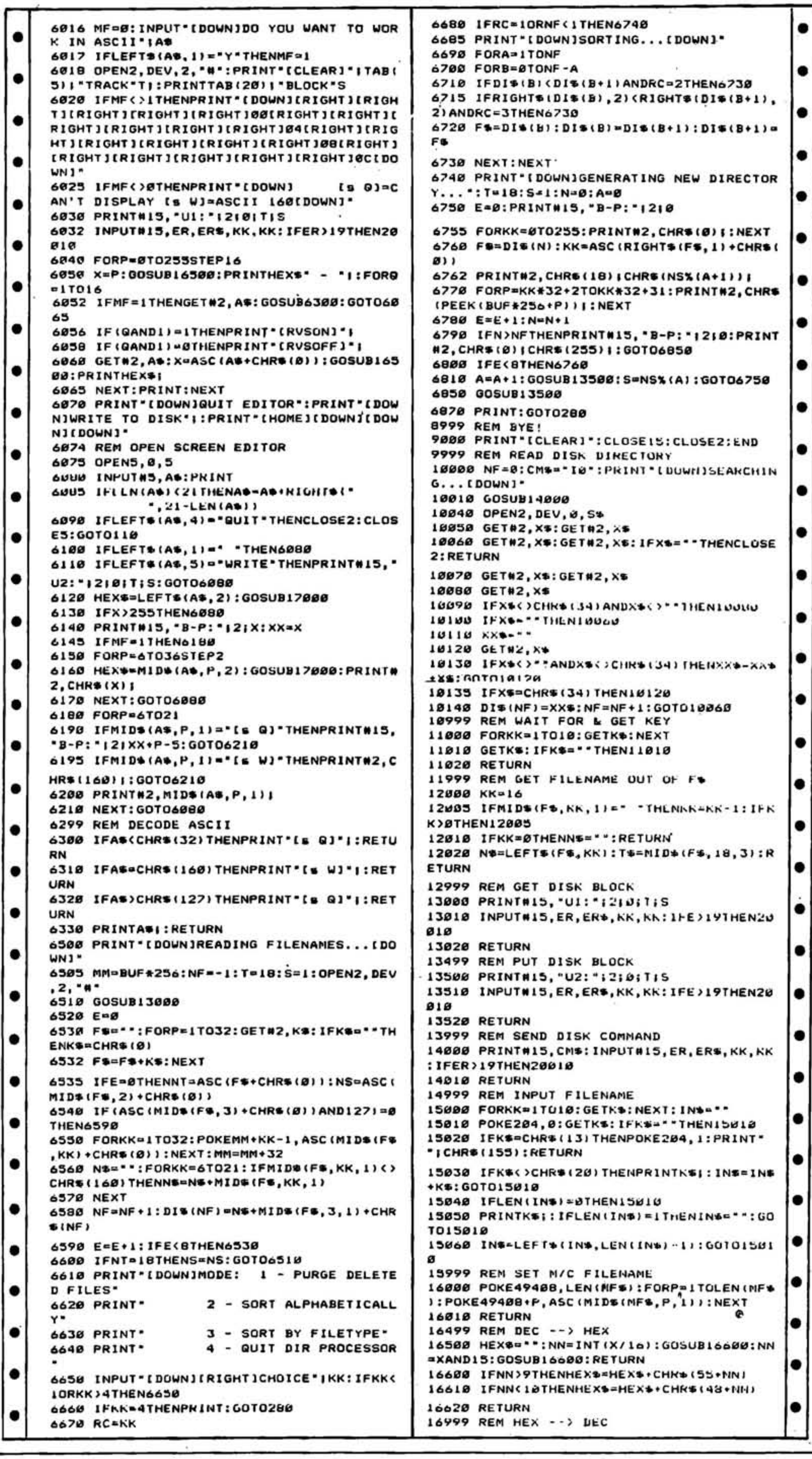
Any sequential type file can be read by opening the file and using INPUT # commands, eg, OPEN 2,8,2,"filename, P,R" will open a PRG file for reading.

Note that *Disk Manager* is set up for 1541 drives using device 8. It can send outputs to device 4 (CBM printer), and these values can be altered by editing line 100.

The machine language routines are used by options A and C for reading and writing sequential disk files into the temporary buffer — they are poked into memory at $C000.

```
98 REM SET VARS & DEFINE BUFFER
99 REM BUF=(BUFFER ADDRESS)/256
100 BUF=64:POKE55,0:POKE56,BUF:CLR:BUF=P
EEK(56):DIMDI$(144),NS%(17):DEV=8:PDV=4
102 GOSUB60000:FORP=0TO17:READNS%(P):NEX
T
105 OPEN15,DEV,15,"UI+"
110 POKE49259,DEV:POKE53280,6:POKE53281,
6:PRINTCHR$(147);CHR$(155)
120 PRINTTAB(5)"****************************
*****"
125 PRINTTAB(5)"*
    *"
130 PRINTTAB(5)"*   C64/1541 DISK MANAGE
R   *"
140 PRINTTAB(5)"* (C) DAVID JONES  07/10
/84 *"
145 PRINTTAB(5)"*
    *"
150 PRINTTAB(5)"****************************
*****[DOWN]"
170 PRINTTAB(6);"A. READ & DISPLAY DIREC
TORY"
180 PRINTTAB(6);"B. RESTORE DELETED FILE
S"
190 PRINTTAB(6);"C. COPY FILES (1 DRIVE)
"
200 PRINTTAB(6);"D. DELETE FILES"
210 PRINTTAB(6);"E. DISPLAY FILE INFO"
220 PRINTTAB(6);"F. FORMAT & TEST DISK"
230 PRINTTAB(6);"G. LOCK FILES"
240 PRINTTAB(6);"H. UNLOCK FILES"
250 PRINTTAB(6);"I. RENAME FILE"
260 PRINTTAB(6);"J. VALIDATE DISK"
270 PRINTTAB(6);"K. EDIT BLOCK"
275 PRINTTAB(6);"L. PROCESS DIRECTORY"
277 PRINTTAB(6);"Q. QUIT MANAGER"
280 FORKK=0TO14:CLOSEKK:NEXT:POKE49261,2
:C$="":INPUT"[DOWN][RIGHT]WHICH";C$:IFC$
=""THEN110
285 IFASC(C$)=81THEN9000
290 IFC$<"A"ORC$>"L"THENPRINT"[UP] ???":
GOTO280
295 KK=ASC(C$)-64:PRINT
300 ONKKGOTO1000,1500,2000,2500,3000,350
0,4000,4500,5000,5500,6000,6500
999 REM PRINT DIRECTORY
1000 MF$="$0":GOSUB16000:POKE251,0:POKE2
52,BUF:POKE49261,0:SYS49152
1002 INPUT"OUTPUT TO PRINTER";K$
1004 IFLEFT$(K$,1)="Y"THENOPEN4,4:GOTO10
10
1006 OPEN4,3
1010 MM=BUF*256+4:PRINT#4
1020 GOSUB1400:IFPEEK(MM+1)=0ANDPEEK(MM+
2)=0THENPRINT#4:GOTO280
1030 MM=MM+3:GOTO1020
1400 PRINT#4,PEEK(MM)+PEEK(MM+1)*256;:MM
=MM+2
1410 IFPEEK(MM)=0THENPRINT#4:RETURN
1420 PRINT#4,CHR$(PEEK(MM));:MM=MM+1:GOT
O1410
1499 REM RECOVER SCRATCHED FILES
1500 PRINT"[DOWN]SCANNING DIRECTORY FOR
SCRATCHED FILES"
1510 RC=0:T=18:S=1:OPEN2,DEV,2,"#"
1520 GOSUB13000
1530 GET#2,A$:NT=ASC(A$+CHR$(0)):GET#2,A
$:NS=ASC(A$+CHR$(0)):E=0
1540 GET#2,T$:GET#2,FT$:GET#2,FS$:F$="":
FORKK=1TO16
1550 GET#2,A$:IFA$=CHR$(160)THEN1570
1560 F$=F$+A$
1570 NEXT
1575 IFF$=""THEN1710
1580 FORKK=1TO9:GET#2,A$:NEXT
1582 GET#2,A$:NB=ASC(A$+CHR$(0)):GET#2,A
$:NB=NB+ASC(A$+CHR$(0))*256
1584 GET#2,A$:GET#2,A$
1590 TY=ASC(T$+CHR$(0)):IFTYAND127<>0THE
N1710
1600 IFFT$<CHR$(1)ORFT$>CHR$(35)ORNB=0TH
ENPRINT"[DOWN]CANNOT RECOVER "F$:GOTO171
0
1610 PRINT"[DOWN]DO YOU WANT TO RECOVER
"F$;:INPUTA$
1620 IFLEFT$(A$,1)<>"Y"THEN1710
1630 INPUT"[DOWN]FILETYPE (SEQ/USR/REL/P
RG) :  ";T$
1640 IFT$="SEQ"THENTY=1:GOTO1690
1650 IFT$="PRG"THENTY=2:GOTO1690
1660 IFT$="USR"THENTY=3:GOTO1690
1670 IFT$="REL"THENTY=4:GOTO1690
1680 PRINT"[DOWN]*** INVALID FILE TYPE":
GOTO1630
1690 RC=1:PRINT#15,"B-P:";2;E*32+2
1700 PRINT#2,CHR$(TYOR128);:PRINT#15,"B-
P:"2;E*32+34
1710 E=E+1:IFE<8THEN1540
1720 GOSUB13500
1730 IFNT<1ORNT>35THENCLOSE2:GOTO1750
1740 S=NS:T=NT:GOTO1520
1750 IFRC=1THEN5500
1760 GOTO280
1999 REM BACKUP FILES
2000 PRINT"[DOWN]COPY WHICH FILES? ";:GO
SUB15000:S$="$"+IN$
2010 GOSUB10000
2020 IFNF<2THENPRINT"[DOWN]*** NO FILES
FOUND":GOTO280
2030 FORA=1TONF-1:F$=DI$(A):GOSUB12000
2035 IFT$<>"PRG"ANDT$<>"SEQ"ANDT$<>"USR"
THENPRINT"[DOWN]CANNOT COPY "N$:GOTO2200
2040 PRINT"[DOWN]FOUND: "N$
2042 PRINT"(C)OPY, (S)KIP, (Q)UIT"
2050 GOSUB11000:IFK$="S"THEN2200
2052 IFK$="Q"THENA=NF-1:GOTO2200
2054 IFK$<>"C"THEN2050
2070 MF$=N$:GOSUB16000
2080 POKE251,0:POKE252,BUF
2090 SYS49152
2095 IFPEEK(252)>159THENPRINT"[DOWN][DOW
N]*** FILE TOO LONG - CANNOT COPY[DOWN]"
:GOTO2200
2100 INPUT#15,ER,ER$,KK,KK:IFER>19THEN20
010
2120 PRINT"[DOWN]INSERT COPY DISK & HIT
A KEY":GOSUB11000
2130 MF$=N$+","+T$+",W":GOSUB16000
2140 POKE253,PEEK(251):POKE254,PEEK(252)
:POKE251,0:POKE252,BUF:SYS49155
2150 INPUT#15,ER,ER$,KK,KK:IFER<20THEN21
98
2160 IFER<>63THEN20010
2165 PRINT"[DOWN]FILE ALREADY EXISTS ON
COPY DISK, ENTER NEW FILENAME ";
2170 PRINT"OR JUST RETURN TO SKIP FILE"
```

```
2180 PRINT"[DOWN][DOWN] .. ";:GOSUB15000
:IFIN$=""THEN2198
2190 N$=IN$:MF$=N$+","+T$+",W":GOSUB1600
0:POKE251,0:POKE252,BUF
2195 SYS49155:GOTO2150
2198 PRINT"[DOWN]INSERT SOURCE DISK & HI
T A KEY":GOSUB11000
2200 NEXT
2210 PRINT"[DOWN]COMPLETE[DOWN][DOWN]":G
OTO280
2499 REM DELETE FILES
2500 PRINT"[DOWN]DELETE WHICH FILES? ";:
GOSUB15000:S$="$"+IN$
2510 GOSUB10000
2520 IFNF<2GOTO2020
2530 FORA=1TONF-1:F$=DI$(A):GOSUB12000
2540 PRINT"[DOWN]FOUND: "N$
2542 PRINT"(D)ELETE, (S)KIP, (Q)UIT"
2550 GOSUB11000:IFK$="S"THEN2600
2552 IFK$="Q"THENA=NF-1:GOTO2600
2554 IFK$<>"D"THEN2550
2560 CM$="S0:"+N$:GOSUB14000
2570 PRINT"FILE DELETED"
2600 NEXT:PRINT:GOTO280
2999 REM DISF FILE INFO (START/END/LEN)
3000 PRINT"[DOWN]LIST WHICH FILES? ";:GO
SUB15000:S$="$"+IN$
3002 INPUT"[DOWN]OUTPUT TO PRINTER";K$
3004 IFLEFT$(K$,1)="Y"THENOPEN4,4:GOTO30
10
3006 OPEN4,3
3010 PRINT#4:GOSUB10000
3020 IFNF<2GOTO2020
3030 FORQ=1TONF-1:F$=DI$(Q):GOSUB12000
3032 IFT$<>"PRG"ANDT$<>"SEQ"ANDT$<>"USR"
THEN3120
3040 MF$=N$:GOSUB16000:IFT$="USR"ORT$="S
EQ"THEN3200
3050 OPEN3,DEV,3,N$:GET#3,A$:GET#3,B$:CL
OSE3
3060 PRINT#4,F$;:X=ASC(B$+CHR$(0)):GOSUB
16500:PRINT#4,SPC(23-LEN(F$));"$"HEX$;
3070 X=ASC(A$+CHR$(0)):GOSUB16500:PRINT#
4,HEX$" - $";
3080 POKE251,0:POKE252,0:SYS49158
3090 LL=PEEK(251)+PEEK(252)*256-2
3100 EA=ASC(A$+CHR$(0))+ASC(B$+CHR$(0))*
256+LL:HI=INT(EA/256)
3110 LO=INT(EA-HI*256):X=HI:GOSUB16500:P
RINT#4,HEX$;:X=LO:GOSUB16500
3115 PRINT#4,HEX$
3120 NEXT:GOTO280
3200 POKE251,0:POKE252,0:SYS49158
3210 LL=PEEK(251)+PEEK(252)*256+1
3220 HI=INT(LL/256):LO=INT(LL-HI*256)
3230 PRINT#4,F$;:X=HI:GOSUB16500:PRINT#4
,SPC(23-LEN(F$));"$"HEX$;
3240 X=LO:GOSUB16500:PRINT#4,HEX$;" ("LL
")"
3250 GOTO3120
3499 REM FORMAT/DISK TEST
3500 PRINT"PLEASE WAIT..":PRINT#15,"I0"
3510 INPUT#15,ER,ER$,KK,KK
3520 IFER=26THEN20010
3530 IFER=74OR(ER>19ANDER<28)THEN3570
3540 IFER>19THEN20010
3550 PRINT"[DOWN][DOWN]";TAB(13);"** WAR
NING! **[DOWN][DOWN]"
3560 PRINT"THIS DISK SEEMS TO BE ALREADY
 FORMATTED .."
3565 PRINT"MODES 1-3 WILL DESTROY ALL DI
SK FILES[DOWN][DOWN]"
3570 PRINT"[DOWN]MODE:  1 - COMPLETE FOR
MAT"
3580 PRINT"         2 - ERASE DIRECTORY TR
ACK"
3590 PRINT"         3 - COMPLETE FORMAT &
TEST DISK"
3600 PRINT"         4 - TEST DISK (NON-DES
TRUCTIVE)"
3605 PRINT"         5 - LEAVE FORMATTER"
3610 INPUT"[DOWN][RIGHT]CHOICE";A
3620 IFA=5THENPRINT:GOTO280
3625 IFA=4THEN3672
3630 PRINT"[DOWN]NEW DISK NAME: ";:GOSUB
15000:N$=IN$
3640 IFA=1ORA=3THENPRINT"[DOWN]DISK ID (
2 CHARS): ";:GOSUB15000:IFLEN(IN$)<>2THE
N3640
3650 CM$="N0:"+N$:IFA=1ORA=3THENCM$=CM$+
","+IN$
3655 PRINT"[DOWN]CONTINUE (Y/N)?":GOSUB1
1000
3658 IFK$<>"Y"THEN280
3660 GOSUB14000
3670 IFA<>3THEN280
3672 MF=0:INPUT"[DOWN]DO YOU WANT TO MAR
K BAD BLOCKS";K$
3674 IFLEFT$(K$,1)="Y"THENMF=1
3679 REM CHECK DISK BLOCKS
3680 PRINT"[DOWN][DOWN]CHECKING DISK[DOW
N][DOWN]"
3690 OE=-1:A=0
3700 T=1:OPEN2,DEV,2,"#"
3710 S=0
3715 PRINT"      TRACK :"T"[LEFT] ":PRINT
"[DOWN]      BLOCK :"S"[LEFT] "
3716 PRINT"[DOWN]BAD BLOCKS :"A"[LEFT]
"
3720 PRINT#15,"U1:";2;0;T;S
3730 INPUT#15,ER,ER$,KK,KK:IFER>19THENA=
A+1
3732 IFER>19ANDMF=1THENPRINT#15,"B-A:";0
;T;S
3735 IFER=OETHENPRINT"[DOWN]":GOTO3750
3736 OE=ER
3740 PRINT"[DOWN][RVSON] DISK STATUS:
                        [LEFT][LEFT][LEFT]
[LEFT][LEFT][LEFT][LEFT][LEFT][LEFT][LEF
T][LEFT][LEFT][LEFT][LEFT][LEFT][LEFT][L
EFT][LEFT][LEFT][LEFT][LEFT][LEFT][LEFT]
[LEFT]"ER$
3750 PRINT"[UP][UP][UP][UP][UP][UP][UP]"
;
3780 S=S+1:IFS<17THEN3715
3790 IFT<18ANDS<21THEN3715
3800 IFT<25ANDS<19THEN3715
3810 IFT<31ANDS<18THEN3715
3820 IFS<17THEN3715
3830 T=T+1:IFT<36THEN3710
3840 PRINT"[DOWN][DOWN][DOWN][DOWN][DOWN
][DOWN][DOWN][DOWN]":IFA=0THENPRINT">> D
ISK PASSES TEST":PRINT:GOTO3860
3850 PRINT"DISK HAS"A"BAD BLOCKS":PRINT
3860 CLOSE2:GOTO280
3999 REM LOCK FILES
4000 PRINT"[DOWN]LOCK WHICH FILES? ";:GO
SUB15000:S$="$"+IN$
4010 GOSUB10000
4020 IFNF<2GOTO2020
4030 FORA=1TONF-1:F$=DI$(A):GOSUB12000:P
RINT"[DOWN]LOCKING  "N$
4040 SF$=N$:LB=64:GOSUB4200
4050 NEXT:GOTO280
4199 REM SET/RESET LOCK BIT
4200 T=18:S=1:OPEN2,DEV,2,"#"
4210 GOSUB13000
4220 GET#2,A$:NT=ASC(A$+CHR$(0)):GET#2,A
$:NS=ASC(A$+CHR$(0)):E=0
4230 GET#2,T$:GET#2,FT$:GET#2,FS$:F$="":
FORKK=1TO16
4240 GET#2,A$:IFA$=CHR$(160)THEN4260
4250 F$=F$+A$
4260 NEXT
4270 FORKK=1TO13:GET#2,A$:NEXT
4280 IFSF$<>F$THEN4340
4290 TY=ASC(T$+CHR$(0)):IFTY<128THENPRIN
T"[DOWN]CANNOT LOCK "F$:GOTO4340
4295 IFTYAND127=0THEN4340
4300 IFFT$<CHR$(1)ORFT$>CHR$(35)THENPRIN
T"[DOWN]CANNOT LOCK "F$:GOTO4340
4310 PRINT#15,"B-P:";2;E*32+2
4320 PRINT#2,CHR$(TYAND191ORLB);
4330 PRINT#15,"B-P:";2;E*32+34
4340 E=E+1:IFE<8THEN4230
4345 GOSUB13500
4350 S=NS:T=NT:IFNT<1ORNT>35THENCLOSE2:R
ETURN
4360 GOTO4210
4499 REM UNLOCK FILES
4500 PRINT"[DOWN]UNLOCK WHICH FILES? ";:
GOSUB15000:S$="$"+IN$
4510 GOSUB10000
4520 IFNF<2GOTO2020
4530 FORA=1TONF-1:F$=DI$(A):GOSUB12000:P
RINT"[DOWN]UNLOCKING  "N$
4540 SF$=N$:LB=0:GOSUB4200
4550 NEXT:GOTO280
4999 REM RENAME FILES
5000 PRINT"[DOWN]ORIGINAL FILENAME? ";:G
OSUB15000:N$=IN$
5010 PRINT"[DOWN]NEW FILENAME? ";:GOSUB1
5000:F$=IN$
5020 CM$="R0:"+F$+"=0:"+N$:GOSUB14000
5030 GOTO280
5499 REM COLLECT/VALIDATE DISK
5500 CM$="V0":PRINT"[DOWN][DOWN]>>> VALI
DATING - PLEASE WAIT! <<<":GOSUB14000
5510 GOTO280
5999 REM 'ZAP' DISK BLOCK
6000 INPUT"TRACK, BLOCK  : ";T,S
6010 IFT<1THEN280
```



```
6016 MF=0:INPUT"[DOWN]DO YOU WANT TO WOR
K IN ASCII";A$
6017 IFLEFT$(A$,1)="Y"THENMF=1
6018 OPEN2,DEV,2,"#":PRINT"[CLEAR]";TAB(
5);"TRACK"T;:PRINTTAB(20);"BLOCK"S
6020 IFMF<>1THENPRINT"[DOWN][RIGHT][RIGH
T][RIGHT][RIGHT][RIGHT]00[RIGHT][RIGHT][
RIGHT][RIGHT][RIGHT][RIGHT]04[RIGHT][RIG
HT][RIGHT][RIGHT][RIGHT][RIGHT]08[RIGHT]
[RIGHT][RIGHT][RIGHT][RIGHT][RIGHT]0C[DO
WN]"
6025 IFMF<>0THENPRINT"[DOWN]      [s Q]=C
AN'T DISPLAY [s W]=ASCII 160[DOWN]"
6030 PRINT#15,"U1:";2;0;T;S
6032 INPUT#15,ER,ER$,KK,KK:IFER>19THEN20
010
6040 FORP=0TO255STEP16
6050 X=P:GOSUB16500:PRINTHEX$" - ";:FORQ
=1TO16
6052 IFMF=1THENGET#2,A$:GOSUB6300:GOTO60
65
6056 IF(QAND1)=1THENPRINT"[RVSON]";
6058 IF(QAND1)=0THENPRINT"[RVSOFF]";
6060 GET#2,A$:X=ASC(A$+CHR$(0)):GOSUB165
00:PRINTHEX$;
6065 NEXT:PRINT:NEXT
6070 PRINT"[DOWN]QUIT EDITOR":PRINT"[DOW
N]WRITE TO DISK";:PRINT"[HOME][DOWN][DOW
N][DOWN]"
6074 REM OPEN SCREEN EDITOR
6075 OPEN5,0,5
6080 INPUT#5,A$:PRINT
6085 IFLEN(A$)<21THENA$=A$+RIGHT$("
             ",21-LEN(A$))
6090 IFLEFT$(A$,4)="QUIT"THENCLOSE2:CLOS
E5:GOTO110
6100 IFLEFT$(A$,1)=" "THEN6080
6110 IFLEFT$(A$,5)="WRITE"THENPRINT#15,"
U2:";2;0;T;S:GOTO6080
6120 HEX$=LEFT$(A$,2):GOSUB17000
6130 IFX>255THEN6080
6140 PRINT#15,"B-P:";2;X:XX=X
6145 IFMF=1THEN6180
6150 FORP=6TO36STEP2
6160 HEX$=MID$(A$,P,2):GOSUB17000:PRINT#
2,CHR$(X);
6170 NEXT:GOTO6080
6180 FORP=6TO21
6190 IFMID$(A$,P,1)="[s Q]"THENPRINT#15,
"B-P:";2;XX+P-5:GOTO6210
6195 IFMID$(A$,P,1)="[s W]"THENPRINT#2,C
HR$(160);:GOTO6210
6200 PRINT#2,MID$(A$,P,1);
6210 NEXT:GOTO6080
6299 REM DECODE ASCII
6300 IFA$<CHR$(32)THENPRINT"[s Q]";:RETU
RN
6310 IFA$=CHR$(160)THENPRINT"[s W]";:RET
URN
6320 IFA$>CHR$(127)THENPRINT"[s Q]";:RET
URN
6330 PRINTA$;:RETURN
6500 PRINT"[DOWN]READING FILENAMES...[DO
WN]"
6505 MM=BUF*256:NF=-1:T=18:S=1:OPEN2,DEV
,2,"#"
6510 GOSUB13000
6520 E=0
6530 F$="":FORP=1TO32:GET#2,K$:IFK$=""TH
ENK$=CHR$(0)
6532 F$=F$+K$:NEXT
6535 IFE=0THENNT=ASC(F$+CHR$(0)):NS=ASC(
MID$(F$,2)+CHR$(0))
6540 IF(ASC(MID$(F$,3)+CHR$(0))AND127)=0
THEN6590
6550 FORKK=1TO32:POKEMM+KK-1,ASC(MID$(F$
,KK)+CHR$(0)):NEXT:MM=MM+32
6560 N$="":FORKK=6TO21:IFMID$(F$,KK,1)<>
CHR$(160)THENN$=N$+MID$(F$,KK,1)
6570 NEXT
6580 NF=NF+1:DI$(NF)=N$+MID$(F$,3,1)+CHR
$(NF)
6590 E=E+1:IFE<8THEN6530
6600 IFNT=18THENS=NS:GOTO6510
6610 PRINT"[DOWN]MODE:  1 - PURGE DELETE
D FILES"
6620 PRINT"         2 - SORT ALPHABETICALL
Y"
6630 PRINT"         3 - SORT BY FILETYPE"
6640 PRINT"         4 - QUIT DIR PROCESSOR
"
6650 INPUT"[DOWN][RIGHT]CHOICE";KK:IFKK<
1ORKK>4THEN6650
6660 IFKK=4THENPRINT:GOTO280
6670 RC=KK
6680 IFRC=1ORNF<1THEN6740
6685 PRINT"[DOWN]SORTING...[DOWN]"
6690 FORA=1TONF
6700 FORB=0TONF-A
6710 IFDI$(B)<DI$(B+1)ANDRC=2THEN6730
6715 IFRIGHT$(DI$(B),2)<RIGHT$(DI$(B+1),
2)ANDRC=3THEN6730
6720 F$=DI$(B):DI$(B)=DI$(B+1):DI$(B+1)=
F$
6730 NEXT:NEXT
6740 PRINT"[DOWN]GENERATING NEW DIRECTOR
Y...":T=18:S=1:N=0:A=0
6750 E=0:PRINT#15,"B-P:";2;0
6755 FORKK=0TO255:PRINT#2,CHR$(0);:NEXT
6760 F$=DI$(N):KK=ASC(RIGHT$(F$,1)+CHR$(
0))
6762 PRINT#2,CHR$(18);CHR$(NS%(A+1));
6770 FORP=KK*32+2TOKK*32+31:PRINT#2,CHR$
(PEEK(BUF*256+P));:NEXT
6780 E=E+1:N=N+1
6790 IFN>NFTHENPRINT#15,"B-P:";2;0:PRINT
#2,CHR$(0);CHR$(255);:GOTO6850
6800 IFE<8THEN6760
6810 A=A+1:GOSUB13500:S=NS%(A):GOTO6750
6850 GOSUB13500
6870 PRINT:GOTO280
8999 REM BYE!
9000 PRINT"[CLEAR]":CLOSE15:CLOSE2:END
9999 REM READ DISK DIRECTORY
10000 NF=0:CM$="I0":PRINT"[DOWN]SEARCHIN
G...[DOWN]"
10010 GOSUB14000
10040 OPEN2,DEV,0,S$
10050 GET#2,X$:GET#2,X$
10060 GET#2,X$:GET#2,X$:IFX$=""THENCLOSE
2:RETURN
10070 GET#2,X$:GET#2,X$
10080 GET#2,X$
10090 IFX$<>CHR$(34)ANDX$<>""THEN10080
10100 IFX$=""THEN10060
10110 XX$=""
10120 GET#2,X$
10130 IFX$<>""ANDX$<>CHR$(34)THENXX$=XX$
+X$:GOTO10120
10135 IFX$=CHR$(34)THEN10120
10140 DI$(NF)=XX$:NF=NF+1:GOTO10060
10999 REM WAIT FOR & GET KEY
11000 FORKK=1TO10:GETK$:NEXT
11010 GETK$:IFK$=""THEN11010
11020 RETURN
11999 REM GET FILENAME OUT OF F$
12000 KK=16
12005 IFMID$(F$,KK,1)=" "THENKK=KK-1:IFK
K>0THEN12005
12010 IFKK=0THENN$="":RETURN
12020 N$=LEFT$(F$,KK):T$=MID$(F$,18,3):R
ETURN
12999 REM GET DISK BLOCK
13000 PRINT#15,"U1:";2;0;T;S
13010 INPUT#15,ER,ER$,KK,KK:IFE>19THEN20
010
13020 RETURN
13499 REM PUT DISK BLOCK
13500 PRINT#15,"U2:";2;0;T;S
13510 INPUT#15,ER,ER$,KK,KK:IFE>19THEN20
010
13520 RETURN
13999 REM SEND DISK COMMAND
14000 PRINT#15,CM$:INPUT#15,ER,ER$,KK,KK
:IFER>19THEN20010
14010 RETURN
14999 REM INPUT FILENAME
15000 FORKK=1TO10:GETK$:NEXT:IN$=""
15010 POKE204,0:GETK$:IFK$=""THEN15010
15020 IFK$=CHR$(13)THENPOKE204,1:PRINT"
";CHR$(155):RETURN
15030 IFK$<>CHR$(20)THENPRINTK$;:IN$=IN$
+K$:GOTO15010
15040 IFLEN(IN$)=0THEN15010
15050 PRINTK$;:IFLEN(IN$)=1THENIN$="":GO
TO15010
15060 IN$=LEFT$(IN$,LEN(IN$)-1):GOTO1501
0
15999 REM SET M/C FILENAME
16000 POKE49408,LEN(MF$):FORP=1TOLEN(MF$
):POKE49408+P,ASC(MID$(MF$,P,1)):NEXT
16010 RETURN
16499 REM DEC --> HEX
16500 HEX$="":NN=INT(X/16):GOSUB16600:NN
=XAND15:GOSUB16600:RETURN
16600 IFNN>9THENHEX$=HEX$+CHR$(55+NN)
16610 IFNN<10THENHEX$=HEX$+CHR$(48+NN)
16620 RETURN
16999 REM HEX --> DEC
```

```
17000 X=0:KK$=RIGHT$(HEX$,1):IFKK$<":"TH
ENX=X+ASC(KK$)-48:GOTO17020
17010 X=X+ASC(KK$)-55
17020 KK$=LEFT$(HEX$,1):IFKK$<":"THENX=X
+(ASC(KK$)-48)*16:RETURN
17030 X=X+(ASC(KK$)-55)*16:RETURN
17200 KK$=RIGHT$(HEX$,1):IFKK$<":"THENX=
X+(ASC(KK$)-48)*16:RETURN
20000 INPUT#15,ER,ER$,KF,KK
20010 PRINT"[DOWN]*** "ER$:GOTO200
59999 REM LOAD M/C ROUTINES
60000 FORP=1TO135:READA:KK=KK+A*P:POKEP+
49151,A:NEXT
60005 IFKK=1364066THENRETURN
60007 PRINT"[CLEAR][DOWN][DOWN][DOWN]***
 DATA STATEMENTS INCORRECT":END
60010 DATA76,42,192,76,69,192,32,104
60020 DATA192,162,2,32,198,255,32,207
60030 DATA255,32,183,255,208,6,32,31
60040 DATA192,76,14,192,76,127,192,230
60050 DATA251,208,2,230,252,165,252,201
60060 DATA160,96,32,104,192,162,2,32
60070 DATA198,255,32,183,255,208,229,32
60080 DATA207,255,162,0,129,251,32,31
60090 DATA192,144,239,176,215,32,104,192
60100 DATA162,2,32,201,255,162,0,161
60110 DATA251,32,210,255,32,183,255,208
60120 DATA195,32,31,192,165,251,197,253
60130 DATA165,252,229,254,144,231,176,18
0
60140 DATA169,2,162,8,160,2,32,186
60150 DATA255,162,1,160,193,173,0,193
60160 DATA32,189,255,32,192,255,96
60170 DATA32,204,255,169,2,76,195,255
60999 REM DIRECTORY SECTORS
61000 DATA1,4,7,10,13,16,2,5,8,11,14,17,
3,6,9,12,15,18
```

Meteor Attack

by Nick Pearce

Occasionally I enjoy a good, traditional zap-'em game and I find there's no better machine than an Atari for games design. Meteor Attack will run on both the old Ataris and the new XLs, and occupies less than 16k.

Little is needed in the way of instruction: just protect the cities from the meteors with shots from the gun tower. The joystick controls the direction of the shots.

The game has all the usual features of arcade games — high scores, multiwave and a two-player cooperative mode. My highest score is 28,700, which I'm sure will be beaten with little or no effort.

N Walker

```
2 GRAPHICS 0:? ,"METEOR ATTACK":? :? "   by Nick Pearce, (c) Oct 84":?
4 GOTO 7000
200 FOR I=0 TO M:IF PEEK(PC+I)>4 THEN 390
210 BB=INT((PEEK(PX+I)-28)/8)+INT((PEEK(PY+I)-26)/8)*24:AA=S+BB
220 IF  NOT PEEK(AA) OR PEEK(AA)=13 OR BB<528 OR BB>550 THEN 300
225 POKE AA,3:SOUND 3,24,10,10:FOR J=0 TO 35:NEXT J
230 BLDNGS=BLDNGS-N1:SOUND 3,0,0,0:POKE AA,13:IF  NOT BLDNGS THEN POP :GOTO 700
300 POKE PY+I,0:POKE PX+I,INT(RND(0)*R1)+R2:POKE PCOLR+I,22:POKE PC+I,40
390 NEXT I
400 FOR I=0 TO N1:IF  NOT PEEK(HIT+I) OR PEEK(GUN+I)<>141 OR  NOT LIVES(I) THEN
490
420 SOUND 3,2,4,10:POKE 710,222:LIVES(I)=LIVES(I)-N1:GOSUB SHOW
430 FOR J=0 TO 44:NEXT J:SOUND 3,0,0,0:POKE 710,218:IF  NOT LIVES(I) THEN 450
440 POKE HIT+I,0:POKE FACE+I,135:GOTO 490
450 IF  NOT LIVES(0) AND  NOT LIVES(N1) THEN POP :GOTO 700
490 NEXT I
495 GOSUB SCORE
500 IF PEEK(CONSOL)=START THEN 700
600 POKE CH+PEEK(LEVEL),0:IF PEEK(LEVEL)<>127 THEN 200
610 LOOP=LOOP+N1
620 IF LOOP=120 THEN R1=85:R2=44
630 IF LOOP=210 THEN R2=80
640 IF LOOP=300 THEN R2=124
650 IF LOOP=390 THEN GOSUB PAUSE:R1=101:R2=14:POKE PSX,N1
660 IF LOOP=590 THEN GOSUB PAUSE:R2=142:POKE PSX,255
670 IF LOOP=790 THEN GOSUB PAUSE:N=N+N1:LOOP=0:R1=163:R2=44:POKE PSX,0:IF N=4 TH
EN N=3
680 M=N:GOTO 200
699 REM ** gameover
700 POKE AUTO,0:SOUND 3,0,0,0
702 POSITION 14,8:? #6;" GAME OVER ":GOSUB SCORE
710 IF PTS>HI THEN HI=PTS:GOSUB SHOW
720 FOR J=0 TO 900:NEXT J
799 REM ** begin
800 POSITION 2,0:? #6;"SCORE  LIVES  HIGH"
801 PTS=0:BLDNGS=10:LIVES(0)=3:LIVES(N1)=3:GOSUB SHOWPTS:GOSUB SHOW
803 FOR I=CH+120 TO CH+127:POKE I,255:NEXT I
804 FOR I=432 TO 455:POKE S+I,207:POKE S+I+120,78:NEXT I
805 FOR I=530 TO 540 STEP 2:POKE S+I,78:POKE S+I+9,78:NEXT I
806 POKE S+514,12:POKE S+517,12:POKE S+538,12:POKE S+541,12
807 POKE HIT,0:POKE HIT+N1,0:POKE FACE,138:POKE FACE+N1,135
808 POKE LEVEL,120:POKE SHIELD,10
810 TIME=400
820 POSITION 4,6:? #6;" meteor attack   "
825 POSITION 14,8:? #6;"   PRESS   "
830 POSITION 0,11:? #6;"RESET to finish"
835 POSITION 8,13:? #6;"OPTION=1 player ";:IF PEEK(SOLO) THEN ? #6;"<":GOTO 845
840 ? #6;" "
845 POSITION 16,15:? #6;"SELECT=2 players";:IF  NOT PEEK(SOLO) THEN ? #6;"<":GOT
O 855
850 ? #6;" "
855 POSITION 4,18:? #6;"START to play"
860 TIME=TIME-N1:IF  NOT TIME THEN 900
870 IF PEEK(CONSOL)=OPTION THEN POKE SOLO,N1
875 IF PEEK(CONSOL)=SELECT THEN POKE SOLO,0
880 IF PEEK(CONSOL)<>START THEN 835
900 POSITION 0,6:FOR I=N1 TO 7:? #6;B$;:NEXT I
910 IF  NOT TIME THEN POSITION 14,8:? #6;"PRESS START":POKE AUTO,N1
930 LOOP=0:R1=163:R2=44:M=3:N=N1:POKE PSX,0
950 FOR I=0 TO 3:POKE PY+I,32:POKE PX+I,0:POKE PC+I,0:NEXT I
990 GOTO 200
1899 REM ** score
1900 PTS=PTS+PEEK(DESTROY)*385:POKE DESTROY,0
1999 REM ** showpts
```

```
2000 N$=STR$(PTS):M$="000000":M$(7-LEN(N$))=N$:POSITION 6,N1:? #6;M$:RETURN
2099 REM ** show
2100 N$=STR$(HI):M$="000000":M$(7-LEN(N$))=N$:POSITION 19,N1:? #6;M$
2200 POSITION 14,N1:? #6;LIVES(0);" ";LIVES(N1):RETURN
3999 REM ** pause
4000 SOUND 3,90,10,8:J=LOOP*M*2+BLDNGS*585
4002 POSITION 4,6:? #6;J;" BONUS POINTS"
4004 PTS=PTS+J:GOSUB SHOWPTS
4005 J=0:FOR I=0 TO 3:IF PEEK(PC+I) THEN J=J+N1:GOTO 4090
4010 BB=INT((PEEK(PX+I)-28)/8)+INT((PEEK(PY+I)-26)/8)*24:AA=A+BB
4020 IF  NOT PEEK(AA) OR PEEK(AA)=13 OR BB<528 OR BB>550 THEN 4090
4030 POKE AA,13:BLDNGS=BLDNGS-N1:IF  NOT BLDNGS THEN POP :POP :POP :GOTO 700
4090 NEXT I:IF J THEN 4005
4100 SOUND 3,0,0,0:POSITION 4,6:? #6;B$(N1,17)
4190 RETURN
6999 REM ** intro
7000 ? "A city is threatened by meteors, its"
7200 ? "only protection is an energy shield"
7220 ? "and 2 laser canons."
7300 ? "You control the canons. They are"
7310 ? "capable of firing energy bolts in"
7320 ? "any of six directions depending on"
7330 ? "the up/centre/down position of the"
7340 ? "stick when the trigger is pressed."
7350 ? "Points are gained for each meteor you"
7360 ? "destroy."
7370 ? "The game ends when either both canons"
7380 ? "or all 10 buildings are destroyed!":?
7390 ? "ONE PLAYER OPTION"
7400 ? "Both canons controlled by joystick 1."
7410 ? "TWO PLAYER OPTION"
7420 ? "joystick1=left, joystick2=right canon":?
7800 ? ,"PRESS START";
7820 CONSOL=53279:START=6:SELECT=5:OPTION=3
7900 IF PEEK(CONSOL)<>START THEN 7900
7999 REM ** init
8000 RAMTOP=106:MYTOP=PEEK(RAMTOP)-12:POKE RAMTOP,MYTOP
8100 GRAPHICS 17:DL=PEEK(560)+256*PEEK(561):S=PEEK(DL+5)*256+PEEK(DL+4)
8120 POKE 708,102:POKE 709,136:POKE 710,218
8220 N1=1:PCOLR=704:AUDCTL=53768:SKCTL=53775:AUDF=53760:AUDC=53761:DESTROY=1609
8240 SHAPAGE=206:TAB=1536:LEVEL=1602:SHIELD=1601:PC=1556
8260 PX=1560:PY=1568:PSX=1608:SOLO=1604:AUTO=1605
8280 FACE=1610:GUN=1612:HIT=1618:GUNLOCX=1620:GUNHI=1626:GUNLO=1628
8300 DIM M$(8),N$(8),LIVES(N1),B$(40)
8310 B$(N1)=" ":B$(40)=" ":B$(2)=B$:HI=0
8320 SCORE=1900:SHOWPTS=2000:SHOW=2100:PAUSE=4000
8400 DIM FILL$(17):FOR I=N1 TO 17:READ J:FILL$(I)=CHR$(J):NEXT I
8410 DATA 104,104,104,133,208,160,0,132,207,104,104,145,207,200,208,251,96
8420 DIM COPY$(23):FOR I=N1 TO 23:READ J:COPY$(I)=CHR$(J):NEXT I
8430 DATA 104,104,104,133,206,104,104,133,208,160,0,132,205,132,207,177,205,145,
207,200,208,249,96
8440 DIM VBION$(10):FOR I=N1 TO 10:READ J:VBION$(I)=CHR$(J):NEXT I
8450 VBION$(3,3)=CHR$(MYTOP+4)
8460 DATA 104,162,0,160,0,169,7,76,92,228
8600 X=USR(ADR(FILL$),6,0):? #6,"WAIT"
8620 FOR I=4 TO 11:X=USR(ADR(FILL$),MYTOP+I,0):NEXT I
8800 FOR I=0 TO N1:X=USR(ADR(COPY$),224+I,MYTOP+I):NEXT I
8810 CH=(MYTOP)*256
8820 FOR I=CH+8 TO CH+119:READ J:POKE I,J:NEXT I:POKE 756,MYTOP
8901 DATA 0,0,4,64,16,2,40,0
8902 DATA 0,68,17,24,168,2,32,8
8903 DATA 0,4,64,42,29,186,64,20
8904 DATA 21,74,54,190,93,134,37,84
8905 DATA 56,124,124,126,126,62,62,28
8906 DATA 12,12,28,24,24,24,60,60
8907 DATA 0,6,14,28,24,24,60,60
8908 DATA 0,0,7,14,28,24,60,60
8909 DATA 48,48,56,24,24,24,60,60
8910 DATA 0,96,112,56,24,24,60,60
8911 DATA 0,0,224,112,56,24,60,60
8912 DATA 24,126,126,126,24,126,126,126
8913 DATA 0,0,0,0,0,24,52,90
8914 DATA 60,36,60,36,60,36,60,90
9000 FOR I=TAB TO TAB+7:READ J:POKE I,J:NEXT I
9010 DATA 3,12,48,192,252,243,207,63
9050 FOR I=1700 TO 1713:READ J:POKE I,J:NEXT I
9060 DATA 72,169,166,141,10,212,141,26,208,141,23,208,104,64
9070 POKE DL+27,134:POKE 512,164:POKE 513,6
9100 MT=(MYTOP+4)*256:FOR I=MT TO MT+707:READ J:POKE I,J:NEXT I
9200 DATA 216,173,69,6,240,48,169,0,141,132,2,141,133,2,206,71
9205 DATA 6,208,20,169,40,141,71,6,238,70,6,173,70,6,201,15
9210 DATA 208,5,169,2,141,70,6,173,70,6,141,120,2,173,70,6
9215 DATA 24,105,3,141,121,2,173,68,6,240,12,173,120,2,141,121
9220 DATA 2,173,132,2,141,133,2,169,62,141,199,2,173,67,6,240
9225 DATA 8,206,67,6,169,54,141,199,2,162,1,189,82,6,208,91
9230 DATA 169,3,157,80,6,189,74,6,157,76,6,188,120,2,152,41
9235 DATA 8,208,8,169,135,157,74,6,157,76,6,152,41,4,208,8
9240 DATA 169,138,157,74,6,157,76,6,152,41,2,208,8,169,2,157
9245 DATA 80,6,254,76,6,152,41,1,208,8,169,4,157,80,6,222
9250 DATA 76,6,56,169,5,253,80,6,157,78,6,189,74,6,201,135
9255 DATA 240,9,56,169,0,253,78,6,157,78,6,189,90,6,133,204
9260 DATA 189,92,6,133,203,160,0,132,77,189,76,6,145,203,202,16
9265 DATA 138,162,1,189,88,6,240,23,138,10,168,222,88,6,208,7
9270 DATA 169,0,153,1,210,240,69,189,88,6,153,0,210,208,61,189
9275 DATA 82,6,208,56,189,132,2,208,51,160,3,185,28,6,208,41
9280 DATA 189,84,6,153,28,6,169,194,153,36,6,189,78,6,153,48
9285 DATA 6,189,80,6,153,44,6,138,10,168,169,19,157,88,6,153
9290 DATA 0,210,169,74,153,1,210,208,3,136,16,207,202,16,164,162
9295 DATA 3,188,8,208,240,63,152,41,8,240,4,160,3,208,20,152
9300 DATA 41,4,240,4,160,2,208,11,152,41,2,240,4,160,1,208
9305 DATA 2,160,0,185,52,6,208,29,169,0,157,28,6,169,7,153
9310 DATA 52,6,169,32,153,20,6,238,73,6,24,173,10,210,41,240
9315 DATA 105,14,153,192,2,202,16,185,162,3,189,52,6,208,73,188
9320 DATA 4,208,240,68,152,41,4,240,18,160,0,189,24,6,16,1
9325 DATA 200,153,82,6,169,141,153,76,6,208,30,152,41,8,240,20
9330 DATA 169,7,141,67,6,206,65,6,208,15,169,10,141,65,6,238
9335 DATA 66,6,208,5,152,41,1,208,15,169,7,157,52,6,169,32
9340 DATA 157,20,6,169,62,157,192,2,202,16,175,162,3,189,20,6
9345 DATA 240,24,189,52,6,208,19,24,189,24,6,109,72,6,157,24
9350 DATA 6,24,189,32,6,105,2,157,32,6,189,28,6,240,46,24
9355 DATA 189,28,6,125,48,6,157,28,6,56,189,36,6,253,44,6
9360 DATA 157,36,6,169,44,221,28,6,176,14,169,211,221,28,6,144
9365 DATA 7,169,10,221,36,6,144,5,169,0,157,28,6,202,16,173
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9370 DATA 169,0,133,209,162,3,189,52,6,240,23,230,209,222,52,6
9375 DATA 208,16,56,189,20,6,233,8,157,20,6,240,5,169,7,157
9380 DATA 52,6,202,16,225,165,209,240,3,24,105,10,160,4,153,1
9385 DATA 210,141,30,208,162,3,189,8,6,133,204,189,12,6,133,203
9390 DATA 169,0,160,255,200,145,203,192,7,208,249,189,32,6,157,12
9395 DATA 6,133,203,189,20,6,133,205,177,205,145,203,136,16,249,189
9400 DATA 24,6,157,0,208,138,72,72,189,4,6,133,209,188,16,6
9405 DATA 162,3,165,209,49,207,145,207,200,202,16,246,104,170,189,36
9410 DATA 6,157,16,6,168,189,0,6,133,209,162,3,165,209,17,207
9415 DATA 145,207,200,202,16,246,104,170,189,28,6,157,4,208,202,16
9420 DATA 149,76,98,228
9600 POKE 54279,MYTOP+4:POKE 623,17:POKE 53260,0
9620 POKE SHAPAGE,MYTOP:POKE 207,0:POKE 208,MYTOP+7:POKE SOLO,1
9640 FOR I=0 TO 3:POKE 1544+I,MYTOP+8+I:POKE 53256+I,0:NEXT I
9700 POKE AUDCTL,0:POKE SKCTL,3:POKE AUDF+4,34
9720 POKE GUNLOCX,115:POKE GUNLOCX+N1,139:POKE 1606,5:POKE 1607,50
9740 K=S+490:I=INT(K/256):J=K-I*256:POKE GUNHI,I:POKE GUNLO,J
9750 K=S+493:I=INT(K/256):J=K-I*256:POKE GUNHI+N1,I:POKE GUNLO+N1,J
9800 POKE 559,63:POKE 53277,3:X=USR(ADR(VBION$)):POKE 54286,192:GOTO 800
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Brimstone Part Three

by Paul Gallagher

To use this program you need to have created an adventure party from Brimstone Part 1 published in December and solved by Brimstone Part 2 published in January 1985. After the dangers of Brimstone Part 2 you finally make it to the local tavern where you can relax. Here the spoils of your previous adventures are shared among the survivors in your party, new experience and hit points are calculated, spells learnt, magical weapon bonuses accrued, and the replenishment of lanterns and rations accomplished. Each character can then be saved to tape individually, thus enabling them to adventure again together in different groups.

If there is sufficient response to the Brimstone Trilogy we'll be publishing a detailed description of how to create your own dungeons. As stated in Part 1 the characters closely follow AD+D format, so your computer-generated characters can of course be used in a *standard* human-moderated game of Dungeons and Dragons.

```
10 'BRIMSTONE PART III:THE TAVERN.  copywrite P. Gallagher 1984
20 PCLEAR1:CLEAR650:DIM TF$(66),EV(66),WC(66)
30 GOSUB3040:GOSUB2790:FORX=1TOXX:LI(X)=0:FORY=1TO8:IFINSTR(1,E$(X,Y),"RATIONS")
<>0THENE$(X,Y)=""
40 IFINSTR(1,E$(X,Y),"TORCH")<>0THENE$(X,Y)=""
44 IFINSTR(1,E$(X,Y),"FLASK")<>0THENE$(X,Y)=""
48 IFINSTR(1,E$(X,Y),"LANTERN")<>0THENE$(X,Y)="LANTERN"
50 NEXTY,X:GOTO110
60 K$=INKEY$:RR=RND(20):IFK$=""THEN60ELSERETURN
70 FORK=1TO2000:NEXT:RETURN
80 FORC=17TO241STEP32:PRINT@C,STRING$(15,32);:NEXT:RETURN
90 CLS:PRINT@33,N$(X);" THE ";C$(X):RETURN
100 FORC=288TO448STEP32:PRINT@C,STRING$(32,32);:NEXT:PRINT@480,STRING$(31,32);:R
ETURN
110 IFR>1THENCLS:PRINT@33,"YOU HAVE NOT FOUND YOUR WAY OUT OF THE DUNGEON YET.IN
 FACT YOUR PARTY IS STILL STUCK IN ROOM";R:PRINT" YOU MUST RELOAD YOUR ADVENTURE
  INTO PROGRAM 'DANDD' AND MAKE   YOUR WAY BACK TO THE ENTRANCE.":END
120 FORX=1TOXX:IFH(X)<1THEN130ELSEGOSUB2860
130 NEXT:CLS:PRINT@235,"the tavern":GOSUB70:CLS:PRINT@33,"WELL DONE. YOUR PARTY
HAVE      SUCCESSFULLY MADE YOUR WAY BACK TO THE NEARBY VILLAGE AND ARE   NOW WA
RMING YOURSELVES WITH     TANKARDS OF THE LOCAL MEAD IN      'the tarnished swor
d'"
140 GOSUB70:PRINT:PRINT" AFTER A GOOD MEAL EVERY-ONE IS  FEELING MUCH RECOVERED
FROM THE RECENT DIFFICULTIES. DIVIDING   OF THE SPOILS IS CALLED FOR BY  ONE AND
 ALL.":PRINT@487,"<PRESS ANY KEY>";:GOSUB60
150 FORX=1TOXX:IFH(X)<1THEN170 ELSECLS:PRINT@33,N$(X);" PLACES :-":PRINT:FORY=1T
O5
160 PRINT" ";T$(X,Y):NEXTY:PRINT" AND";G(X);"GOLD.":PRINT:PRINT" ON THE TABLE.":
PRINT@487,"<PRESS ANY KEY>";:GOSUB60
170 NEXT:CLS:PRINT@33,"DO YOU WISH TO REVIEW":PRINT" THE SPOILS (Y/N)":GOSUB60:I
FK$="Y"THEN150
180 FORX=1TOXX:IFQ(X)>QQ THENQQ=Q(X)
190 TG=TG+G(X):FORY=1TO5:TT$(X,Y)=T$(X,Y):T$(X,Y)="":NEXTY,X:GT=TG
200 FORX1=1TOXX:IFH(X1)<1THEN220ELSEFORY1=1TO5:IFTT$(X1,Y1)<>""THENGOSUB860:GOSU
B920:X1=1:Y1=1
210 NEXTY1
220 NEXTX1:FORX=1TOXX:IFH(X)<1THEN240ELSE CLS:PRINT" ";N$(X);" HAS GAINED:":FORY
=1TO5:IFT$(X,Y)=""THEN230ELSEPRINT" ";T$(X,Y)
230 NEXTY:PRINT:PRINT" FOR ITEMS SOLD OR GOLD TAKEN    IN L1EU OF OTHER TREASURE
:":PRINTGE(X);"GP.":GOSUB60
240 NEXTX:GOSUB2390:GOSUB1270
250 IFCC=1THENGOSUB420
260 GOSUB1290
270 MP=MT+GT+FT:BE=MP/ET:CLS:PRINT:PRINT" EXPERIENCE GAINED (FROM COMBAT  AND GO
LD & GEMS DISCOVERED)     DURING YOUR RECENT ADVENTURE:"
280 PRINT:FORX=1TOXX:IFH(X)<1THEN290ELSEIE(X)=INT(BE*EM(X)):PRINT" ";N$(X);IE(X)
;"EXP.POINTS."
290 NEXT:GOSUB60:FORX=1TOXX:IFH(X)<1THEN360ELSEGOSUB90:PRINT:PRINT" EXPERIENCE B
ONUSES FROM MAGICAL ITEMS BROUGHT BACK....":PRINTAB(X);"EXP.POINTS"
300 PRINT" TOTAL EXPERIENCE GAINED =";IE(X)+AB(X)
310 E(X)=E(X)+IE(X)+AB(X)
320 PRINT" CURRENT TOTAL:";E(X);"E.P.":GOSUB2480:PRINT" NEW HIT POINTS=";NH
330 IFCB>0THENPRINT" CONSTITUTION BONUS=";CB;"HP"
340 PRINT" NEW TOTAL:";HP(X);"+";NH;:IFCB>0THENPRINT"+";CB;
350 HP(X)=HP(X)+NH+CB:PRINT"=";HP(X);"HP.";:GOSUB60
360 NEXTX:FORX=1TOXX:IFH(X)<1THEN380ELSEIFC$(X)="MAGICIAN"ORC$(X)="ILLUSIONIST"O
RC$(X)="CLERIC"ORC$(X)="DRUID"THENGOSUB490
370 IFMC=1THENGOSUB650
380 MC=0:NEXTX:GOSUB1320:GOSUB1560:GOSUB1920:GOSUB2200
390 FORX=1TOXX:IFH(X)<1THEN400ELSEGOSUB2860
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400 NEXT:GOSUB2700'*SAVE CHARACTERS*
410 CLS:PRINT@203,"GOOD LUCK":PRINT@234,"IN YOUR NEXT":PRINT@267,"ADVENTURE":END
420 '*** DEAD COMRADES ***
430 CLS:PRINT@35,"A BONUS FOR THE THOUGHTFUL.":GOSUB70
440 PRINT@97,"YOU WERE UNFORTUNATE TO LOSE A  GOOD COMRADE DURING YOUR RECENT AD
VENTURE,BUT WERE SUFFICIENTLY CONSIDERATE TO CARRY THE BODY   OUT OF THE DUNGEON
 FOR A DECENT BURIAL.":GOSUB70
450 ONRND(3)GOTO460,470,460
460 FG=100*RND(100):FT=FG*XX:PRINT" YOUR DEAD COMRADE, YOU NOW      DISCOVER, CO
MES FROM A WEALTHY  FAMILY CLAN,AND IN APPRECIATION OF YOUR WORTHY DEED HAVE AGR
EED TO AWARD EACH OF YOU";FG;"IN    GOLD AND GEMS.":GOSUB60:RETURN
470 FG=10*RND(100):FT=FG*XX:PRINT" THE FAMILY OF THE DEAD COMRADE  ARE VERY GRAT
EFUL AND IN        RECOGNITION OF YOUR FORMER      FRIENDSHIP PRESS YOU TO ACCEP
T  A GIFT OF";FG;"GP EACH.":GOSUB60:RETURN
480 '** SCROLLS & SPELLS **
490 MC=0:GOSUB90:PRINT@97,"YOU HAVE THE FOLLOWING SPELLS:":PRINT
500 FORY=1TO8:IFS$(X,Y)<>""THENPRINTY;S$(X,Y)
510 NEXT:GOSUB60:GOSUB90:PRINT@97,"YOU HAVE THESE ITEMS:":PRINT:FORY=1TO5:IFT$(X
,Y)<>""THENPRINT" ";T$(X,Y):MC=1
520 NEXT:PRINT@417,"DO YOU WISH A REVIEW OF YOUR    SPELLS & SCROLLS (Y/N)":GOSU
B60:IFK$="Y"THEN490
530 GOSUB90
540 PRINT@96," YOU MAY CONVERT SCROLLS INTO    SPELLS IF YOUR REQUISITE        A
BILITIES ARE HIGH ENOUGH.      YOU MAY ALSO PLACE SPELLS ONTO  SCROLLS TO PROVID
E SPACE FOR    MORE POWERFUL SPELLS IN YOUR    SPELL BOOK, BUT THIS WILL COST  G
OLD!"
550 SP=35:IFI(X)>9ANDI(X)<13THENSP=45
560 IFI(X)=13ORI(X)=14THENSP=55
570 IFI(X)=15ORI(X)=16THENSP=65
580 IFI(X)=17THENSP=75
590 IFI(X)=18THENSP=85
600 IFC$(X)="MAGICIAN"ORC$(X)="ILLUSIONIST"THENPRINT" YOUR CHANCE OF UNDERSTANDI
NG    A NEW SPELL IS";SP;"%"
610 IFC$(X)="CLERIC"ORC$(X)="DRUID"THENSP=100:PRINT" AS A ";C$(X);" YOU UNDERSTA
ND ALL   SPELLS OF YOUR LEVEL."
620 PRINT" DO YOU WISH TO AVAIL YOURSELF   OF THIS OPTION (Y/N)":GOSUB60:IFK$="N
"THENMC=0
630 RETURN
640 '*SPELL/SCROLL INTERCHANGE*
650 FORY=1TO8:IFS$(X,Y)=""ANDMC=1THENGOSUB790ELSENEXT
660 FORY=1TO5:IFT$(X,Y)<>""THEN670ELSENEXT:RETURN
670 GOSUB90:PRINT@129,"IN THIS GAME YOU ARE ALLOWED    TO HAVE ONLY A MAXIMUM OF
 EIGHT SPELLS IN YOUR SPELL BOOK, AND  YOUR BOOK IS NOW FULL.
680 PRINT" HOWEVER, YOU MAY CONVERT SPELLS INTO SCROLLS AND THEN ATTEMPT   TO ST
UDY OTHER SCROLLS WITH A   VIEW TO PUTTING THEM INTO YOUR  SPELL-BOOK."
690 PRINT" DO YOU WANT TO AVAIL YOURSELF   OF THIS OPTION (Y/N)":GOSUB60:IFK$<>"
Y"THENRETURN
700 GOSUB90:PRINT:PRINT" WHICH SPELL DO YOU WANT TO PUT  ONTO A SCROLL.":INPUTTC
$:FORY=1TO8:IFTC$<>S$(X,Y)THENNEXT:PRINT" YOU DO NOT HAVE A SPELL OF":PRINT" ";T
C$:GOSUB70:GOTO690
710 F=0:FORZ=2TO63:F=INSTR(13,TF$(Z),TC$):IFF=0THENNEXTZ:PRINT" THIS SPELL DOES'
NT SEEM TO EXIST":GOSUB70:GOTO690
720 IFGP(X)<5*EV(Z)THENPRINT" UNFORTUNATELY, YOU HAVE           INSUFFICIENT GOLD
TO ACHIEVE    YOUR DESIRES.":GOSUB70:RETURN
730 PRINT" THIS WILL COST YOU THE SUM OF  ";5*EV(Z);"GP IN TIME & MONEY.":PRINT"
 DO YOU WISH TO PROCEED (Y/N)":GOSUB60:IFK$<>"Y"THEN690
740 FORY1=1TO5:IFT$(X,Y1)<>""THENNEXT:GOSUB90:PRINT@161,"AH!AH! YOU NOT ONLY HAV
E A FULL SPELL-BOOK OF EIGHT SPELLS BUT  CARRY THE ALLOWED MAXIMUM OF    FIVE SC
ROLLS.YOU WILL HAVE TO   USE OR SELL SCROLLS AT THE NEXT OPPORTUNITY."GOSUB60:RE
TURN
750 T$(X,Y1)="SCROLL...OF "+TC$:S$(X,Y)="":GP(X)=GP(X)-5*EV(Z)
760 PRINT" scroll successfully written    IF YOU WISH TO PRODUCE A         FURTH
ER SCROLL PRESS 'Y' OR 'S' IF YOU WANT TO PUT ONE OF YOUR  OTHER SCROLLS INTO YO
UR SPELL   BOOK.":GOSUB60:IFK$="Y"THEN690
770 IFK$="S"THEN650
780 RETURN
790 GOSUB90:PRINT@129,"WHICH SCROLL DO YOU WISH TO     STUDY & CONVERT TO A NEW
SPELL?"
800 F=0:INPUTTC$:FORY=1TO5:SC$=MID$(T$(X,Y),13,5):IFSC$=""THEN810ELSEF=INSTR(1,T
C$,SC$):IFF<>0THEN820
810 NEXTY:PRINT" YOU DO NOT HAVE A SCROLL OF":PRINT" ";TC$:GOSUB70:GOTO790
820 K=RND(100):IFK>SP THENPRINT" UNSUCCESSFUL.SPELL LOST UPON    BEING READ.":GO
SUB70:T$(X,Y)="":GOSUB490:RETURN
830 PRINT" successful":GOSUB70:FORZ=1TO8:IFS$(X,Z)<>""THENNEXTZ:RETURN
840 S$(X,Z)=MID$(T$(X,Y),13,18):T$(X,Y)="":GOSUB490:RETURN
850 '***** DICE THROWING *****
860 FORX=1TOXX:RC(X)=0:FORZ=1TO L(X):RT=RND(20):IFRC(X)<RT THEN RC(X)=RT
870 NEXTZ,X:FORX=1TOXX:IFRC(X+1)=RC(X) OR RC(X+2)=RC(X) OR RC(X+3)=RC(X) THEN 86
0 ELSE NEXT
880 FORX=1TOXX:RO(X)=RC(X):NEXT
890 FORX=1TOXX:M(X)=X:FORY=X+1TOXX:IFRC(M(X))<RC(Y)THENM(X)=Y
900 NEXTY:N=RC(X):P(X)=RC(M(X)):RC(M(X))=N:NEXTX:RETURN
910 '*** CHOICE ROUTINE ***
920 CLS:PRINT:PRINT" AFTER A LENGTHY SESSION OF      DICE THROWING....":GOSUB105
0:PRINT:PRINT" THE FIRST CHOICE FALLS TO.....":FORY=1TOXX:FORX=1TOXX:IFRO(X)=P(Y
)THEN930ELSENEXTX,Y
930 GOSUB100:PRINT@289,N$(X);", WHO THREW ";P(Y)
940 K$="":PRINT@321,"WHICH ITEM DO YOU CHOOSE":PRINT" (YOU MUST TYPE THE DESCRIP
TION  PRECISELY, INCLUDING ALL DOTS.)":INPUT" ";TC$
950 FORZ=1TOXX:FORI=1TO5:IFTC$=TT$(Z,I)THEN970ELSENEXTI,Z
960 PRINT@449,"THAT ITEM IS NOT HERE":GOSUB70:PRINT@449,"":GOTO940
970 GOSUB1080:IFK$="A"THEN940
980 IFK$="G"THENGE(X)=GE(X)+EV(I):TG=TG-EV(I):PRINT" IT'S WORTH ",EV(I);"GOLD.":
GOSUB70:GOTO1020
990 IFK$="S"THENGE(X)=GE(X)+EV(T):GOSUB100:PRINT@385,"IT FETCHES";EV(T),"GOLD.":
TT$(Z,I)="":GOSUB70:GOTO1020
1000 FORJ=1TO5:IFT$(X,J)=""THENT$(X,J)=TC$:GOSUB1770:TT$(Z,I)="":GOTO1010ELSENEX
TJ
1010 FORX3=1TOXX:FORY3=1TO5:IFTT$(X3,Y3)=""THENNEXTY3,X3:RETURN
1020 PRINT@33,"NEXT CHARACTER...":NEXTY
1030 CLS:PRINT@33,"ITEMS REMAINING:":PRINT:FORX2=1TOXX:FORY2=1TO5:IFTT$(X2,Y2)="
"THEN1040ELSEPRINT" ";TT$(X2,Y2)
1040 NEXTY2,X2:GOSUB60:RETURN
1050 PRINT:FORY2=1TOXX:FORX2=1TOXX:IFRO(X2)=P(Y2)THEN1060ELSENEXTX2
1060 PRINT" ";N$(X2);" ROLLED A MAXIMUM OF";P(Y2):NEXTY2:GOSUB60:CLS:RETURN
1070 '** ITEM COMPATIBILITY **
1080 FORT=1TO66:IFTC$=TF$(T)THEN1100ELSENEXT
1090 IFT>66THENRETURN
1100 C1$=LEFT$(C$(X),1):IFWC(T)=1 THENRETURN
1110 IFWC(T)=2ANDC1$="M"THENRETURN
1120 IFWC(T)=3ANDC1$="I"THENRETURN
1130 IFWC(T)=4ANDC1$="C"THENRETURN
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1140 IFWC(T)=5ANDC1$="D"THENRETURN
1150 IFWC(T)=6AND(C1$="F"ORC1$="P"ORC1$="R")THENRETURN
1160 IFWC(T)=7AND(C1$="C"ORC1$="D")THENRETURN
1170 IFWC(T)=8AND(C1$="F"ORC1$="P"ORC1$="R"ORC1$="C")THENRETURN
1180 IFWC(T)=9AND(C1$="F"ORC1$="P"ORC1$="R"ORC1$="T"ORC1$="A")THENRETURN
1190 IFWC(T)=10AND(C1$="M"ORC1$="C")THENRETURN
1200 IFWC(T)=11AND(C1$="M"ORC1$="D")THENRETURN
1210 IFWC(T)=12AND(C1$="M"ORC1$="I")THENRETURN
1220 IFWC(T)=13AND(C1$="F"ORC1$="P"ORC1$="R"ORC1$="D")THENRETURN
1230 IFWC(T)=14ANDC1$<>"C"ANDC1$<>"D"THENRETURN
1240 PRINT@320,"":PRINT" THIS ITEM IS NOT COMPATIBLE     WITH YOUR CHARACTER'S C
LASS.":PRINT" YOU MAY CHOOSE aGAIN, sELL THIS ITEM OR TAKE EQUIVALENT gOLD.":GOS
UB60
1250 IFK$="A"ORK$="G"ORK$="S"THENGOSUB100:RETURNELSE1240
1260 '**** GOLD SHARE ****
1270 GX=INT(TG/XX):GD=XX:FORX=1TOXX:IFH(X)<1THENGD=GD-1:GX=INT(TG/GD)
1280 NEXTX:CLS:PRINT" TOTAL REMAINING GOLD FOUND BY    THE PARTY IS";TG;"GP":PRIN
T" EQUAL SHARES AMOUNT TO......     ";GX;"EACH.":GOSUB60:RETURN
1290 CLS:PRINT@33,"TOTAL GOLD NOW OWNED BY EACH     CHARACTER IS:-":PRINT:FORX=1T
OXX:IFH(X)<1THEN1300ELSEGP(X)=GP(X)+GX+FG+GE(X)+AB(X):PRINT"  ";N$(X);GP(X);"GOLD
."
1300 NEXTX:GOSUB60:RETURN
1310 '***** AC ADJUSTMENT *****
1320 FORX=1TOXX:IFH(X)<1THEN1540ELSEFORY=1TO5:K=0:K1=0:K2=0:K3=0:K4=0:K5=0:K6=0:
KK$="":KA$="":IFT$(X,Y)=""THEN1520
1330 K1=INSTR(1,A$(X),"SHIELD"):K2=INSTR(1,A$(X),"SHIELD+1"):K3=INSTR(1,A$(X),"S
HIELD+2"):K4=INSTR(1,A$(X),"CLOAK"):K5=INSTR(1,A$(X),"RING+1")
1340 IFK1<>0THENKA$=" & SHIELD":K=1
1350 IFK2<>0THENKA$=" & SHIELD+1":K=2
1360 IFK3<>0THENKA$=" & SHIELD+2":K=3
1370 IF(T$(X,Y)=TF$(11)AND(K2<>0ORK3<>0))OR(T$(X,Y)=TF$(33)ANDK3<>0)THENT$(X,Y)=
"":KA$=""
1380 IFT$(X,Y)=TF$(10)THENAC(X)=4:A$(X)="CHAINMAIL+1":T$(X,Y)="":K6=1
1390 IFT$(X,Y)=TF$(11)ANDK1=0ANDK2=0THENKA$=" & SHIELD+1":K=2:T$(X,Y)=""
1400 IFT$(X,Y)=TF$(11)ANDK1<>0ANDK2=0THENKA$="+1":K=1:T$(X,Y)=""
1410 IFT$(X,Y)=TF$(21)ANDK4=0THENKA$=" & CLOAK+1":K=1:T$(X,Y)=""
1420 IFT$(X,Y)=TF$(30)ANDK5=0THENKA$=" & RING+1":K=1:T$(X,Y)=""
1430 IFT$(X,Y)=TF$(32)THENAC(X)=3:A$(X)="CHAINMAIL+2":T$(X,Y)="":K6=1
1440 IFT$(X,Y)=TF$(33)ANDK1=0THENKA$=" & SHIELD+2":K=3:T$(X,Y)=""
1450 IFT$(X,Y)=TF$(33)ANDK1=0ANDK2=0THENKA$=" & SHIELD+2":K=3:T$(X,Y)=""
1460 IFT$(X,Y)=TF$(33)ANDK1<>0ANDK2=0THENKA$="+2":K=2:T$(X,Y)=""
1470 IFT$(X,Y)=TF$(33)ANDK2<>0ANDK3=0THENA$(X)=LEFT$(A$(X),K2-1):KA$="SHIELD+2":
K=1:T$(X,Y)=""
1480 IFT$(X,Y)=TF$(45)THENAC(X)=2:A$(X)="PLATEMAIL+1":T$(X,Y)="":K6=1
1490 IFT$(X,Y)=TF$(64)THENAC(X)=1:A$(X)="PLATEMAIL+2":T$(X,Y)="":K6=1
1500 IFK6=1ANDK4<>0THENKK$=" & CLOAK+1":K=K+1ELSEIFK6=1ANDK5<>0THENKK$=" & RING+
1":K=K+1
1510 IFKK$<>""ORKA$<>""THENA$(X)=A$(X)+KK$+KA$:AC(X)=AC(X)-K:IFAC(X)<-3THENAC(X)
=-3
1520 NEXTY:GOSUB90:PRINT@97,"YOUR PRESENT ARMOUR":PRINT" CONSISTS OF.....":PRINT
@192," ";A$(X)
1530 PRINT@257,"AND YOUR ARMOUR CLASS IS:";AC(X):PRINT@329,"----***----":GOSUB60
1540 NEXTX:RETURN
1550 '** SB & DB ADJUSTMENTS **
1560 FORX=1TOXX:FORY=1TO5:IFH(X)<1THEN1620ELSEK1=0:K6=0:K1=INSTR(1,T$(X,Y),"+"):
K2=INSTR(1,T$(X,Y),"."):IFT$(X,Y)=""ORK1=0THEN1620
1570 IFK1<>0THENK3$=LEFT$(T$(X,Y),K2-1):K4$=K3$+RIGHT$(T$(X,Y),2):K5=VAL(RIGHT$(
T$(X,Y),1))
1580 IFW1$(X)<>""ANDW2$(X)<>""ANDW3$(X)<>""THENGOSUB1630
1590 IFW1$(X)=""ANDK1<>0THENW1$(X)=K4$:T$(X,Y)="":GOSUB1710
1600 IFW2$(X)=""ANDK1<>0THENW2$(X)=K4$:T$(X,Y)="":GOSUB1710
1610 IFW3$(X)=""ANDK1<>0THENW3$(X)=K4$:T$(X,Y)="":GOSUB1710
1620 NEXTY,X:RETURN
1630 GOSUB90:PRINT@97,"YOU ARE CARRYING THE MAXIMUM OF THREE WEAPONS.":PRINT:PRI
NT" ";W1$(X):PRINT" ";W2$(X):PRINT" ";W3$(X)
1640 PRINT" DO YOU WISH TO SELL ONE OF      YOUR CURRENT WEAPONS,THUS       ALLO
WING YOU TO CARRY A NEW     ONE? (Y/N)":GOSUB60:IFK$="N"THENRETURN
1650 IFK$<>"Y"THEN1630ELSEWV=RND(200)
1660 PRINT@417,"WHICH ONE?";:INPUTK$:IFK$=W1$(X)THENW1$(X)="":K6=1
1670 IFK$=W2$(X)THENW2$(X)="":K6=1
1680 IFK$=W3$(X)THENW3$(X)="":K6=1
1690 IFK6<>1THEN1660
1700 GP(X)=GP(X)+WV:PRINT" YOU GET";WV;"GP FOR IT.":GOSUB70:RETURN
1710 GOSUB90:PRINT@97,"YOU HAVE JUST ADDED A -":PRINT@133,K4$:PRINT@161,"TO YOUR
 PERSONAL ARMOURY."
1720 IFINSTR(1,W1$(X),"+")<>0THENS1=VAL(RIGHT$(W1$(X),1)):D1=INT(S1/2)
1730 IFINSTR(1,W2$(X),"+")<>0THENS2=VAL(RIGHT$(W2$(X),1)):D2=INT(S2/2)
1740 IFINSTR(1,W3$(X),"+")<>0THENS3=VAL(RIGHT$(W3$(X),1)):D3=INT(S3/2)
1750 PRINT@225,"YOU NOW CARRY -":PRINT@257,"weapon        strike   damage":PRINT@
302,"bonus    bonus":PRINT@321,W1$(X),S1;"       ";D1:PRINT" ";W2$(X),S2;"       ";D
2:PRINT" ";W3$(X),S3;"       ";D3:GOSUB60:RETURN
1760 '** ARTIFACTS BONUS **
1770 FORK=1TO66:IFTC$=TF$(K)THEN1780ELSENEXT
1780 IFK=24ORK=36ORK=37ORK=47ORK=48ORK=58ORK=59ORK=65ORK=66THEN1810
1790 IFK>66THENK=0:RETURN
1800 AB(X)=AB(X)+EV(K):RETURN
1810 IFQQ=0ANDK=24THENQQ=1
1820 IFQQ=1ANDK=36THENQQ=2
1830 IFQQ=2ANDK=37THENQQ=3
1840 IFQQ=3ANDK=47THENQQ=4
1850 IFQQ=4ANDK=48THENQQ=5
1860 IFQQ=5ANDK=58THENQQ=6
1870 IFQQ=6ANDK=59THENQQ=7
1880 IFQQ=7ANDK=65THENQQ=8
1890 IFQQ=8ANDK=66THENQQ=9
1900 FORK=1TOXX:Q(K)=QQ:NEXTK:RETURN
1910 '** QUEST STATUS **
1920 CLS:IFQQ>0THENPRINT@32,"THE QUEST FOR THE CROWN OF POWER":PRINT@97,"YOUR PA
RTY HAS DISCOVERED-"ELSERETURN
1930 ONQQ GOTO 2020,2010,2000,1990,1980,1970,1960,1950,1940
1940 PRINT" **THE ";TF$(66);"**"
1950 PRINT" THE ";TF$(65)
1960 PRINT" THE ";TF$(59)
1970 PRINT" THE ";TF$(58)
1980 PRINT" THE ";TF$(48)
1990 PRINT" THE ";TF$(47)
2000 PRINT" THE ";TF$(37)
2010 PRINT" THE ";TF$(36)
2020 PRINT" THE ";TF$(24)
2030 IFQQ<9THENPRINT@449,"YOUR QUEST MUST CONTINUE!":GOSUB60:RETURN
2040 GOSUB60:CLS:PRINT@33,"WELL DONE YOU HAVE RECOVERED     THE LOST CROWN OF POW
ER AND      ALL OF  THE GEMS OF CONTROL.":PRINT" THE GEMS FIT PERFECTLY INTO
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VARIOUS MATCHING APERTURES       WITHIN THE CROWN."
2050 PRINT" WHEN COMPLETE AND PLACED ON     THE HEAD IT IMPARTS THE         ABIL
ITY OF THE CHARACTER TO     INCREASE ANY   TWO OF THEIR     CHARACTERISTICS    B
Y JUST       WISHING!":GOSUB60
2060 FORX=1TOXX::CLS:PRINT@33,"WHICH DO YOU WISH TO INCREASE?  BUT REMEMBER YOU
CANNOT RAISE   A CHARACTERISTIC ABOVE 18 SO    DON'T WASTE YOU CHANCE."
2070 PRINT:PRINT" 1.STRENGTH.":PRINT" 2.INTELLIGENCE.":PRINT" 3.WISDOM."
2080 PRINT" 4.CONSTITUTION.":PRINT" 5.DEXTERITY.":PRINT" 6.CHARISMA."
2090 FORY=1TO2:PRINT@416,N$(X);" THE ";C$(X)
2100 GOSUB60:K=VAL(K$):IFK<1ORK>6THEN2100
2110 ONK GOTO 2120,2130,2140,2150,2160,2170
2120 S(X)=S(X)+RND(2):GOTO2180
2130 I(X)=I(X)+RND(2):GOTO2180
2140 W(X)=W(X)+RND(2):GOTO2180
2150 C(X)=C(X)+RND(2):GOTO2180
2160 D(X)=D(X)+RND(2):GOTO2180
2170 R(X)=R(X)+RND(2):GOTO2180
2180 PRINTK;" AND":NEXTY,X:RETURN
2190 '*** REPLENISH RATIONS ***
2200 FORX=1TOXX:IFH(X)<1THEN2320ELSEGOSUB90
2210 PRINT@161,"YOU HAVE CONSUMED ALL OF YOUR   SUPPLIES AND MUST REPLENISH
YOUR RATIONS IN READINESS FOR   ANY FUTURE ADVENTURE."
2220 PRINT" YOU HAVE ALSO USED UP ALL OF    YOUR TORCHES AND THE OIL IN     YOUR
 LANTERNS.":GOSUB60
2230 CLS:PRINT@33,"THE VILLAGE TRADERS ARE A WILY  BUNCH AND WORD HAS QUICKLY
   CIRCULATED OF YOUR PARTY'S      GOOD FORTUNE AND YOUR MERRY     MAKING IN THE
 TAVERN."
2240 PRINT" CONSEQUENTLY, THEY HAVE         INCREASED THE PRICES OF THESE   ITEM
S AS FOLLOWS:"
2250 PRINT" RATIONS    40 GP EACH.":PRINT" TORCHES    12 GP/10":PRINT" OIL
  25 GP/FLASK."
2260 FORZZ=1TO2STEP0:PRINT@385,"DO YOU WISH TO REPLACE ANY OF   THESE ITEMS (Y/N
)":PRINT:GOSUB60:IFK$="N"THEN2320
2270 PRINT@385,"WHAT DO YOU WISH TO REPLACE?":PRINT" ":INPUTIR$
2280 IFINSTR(1,IR$,"RATION")<>0THENPRINT@385,"CERTAINLY.THESE RATIONS ARE      VE
RY SUBSTANTIAL AND WILL LAST  YOU A WEEK.":GP(X)=GP(X)-40:GOSUB2330
2290 IFINSTR(1,IR$,"OIL")<>0THENPRINT@385,"OIL FOR YOUR LANTERN?":PRINT" YES, TH
ERE YOU ARE.THAT SHOULD  LAST YOU SEVERAL HOURS!":GP(X)=GP(X)-25:LI(X)=LI(X)+10:
GOSUB2330
2300 IFINSTR(1,IR$,"TORCH")<>0THENPRINT@385,"TORCHES? WE ONLY SELL THEM IN   TEN
S. THERE YOU ARE, 10GP FOR   THE TOTAL.":GP(X)=GP(X)-12:LI(X)=LI(X)+10:GOSUB2330
~~2310 GOSUB60:IFK1=1THEN2230ELSENEXTZZ~~
2320 NEXTX:RETURN
2330 K1=0:FORY=1TO8:IFE$(X,Y)=""THEN2370ELSENEXT
2340 CLS:GOSUB90:PRINT" YOU ARE OVERLOADED. APART FROM  YOUR WEAPONS YOU ARE CAR
RYING:":FORZ=1TO8:PRINT" ";E$(X,Z):NEXT:PRINT" DO YOU WISH TO DROP ANYTHING?   (
Y/N)":GOSUB60:IFK$="N"THENRETURN
2350 PRINT@417,"WHAT";:INPUTDI$:FORZ=1TO8:IFINSTR(1,E$(X,Z),DI$)<>0THENE$(X,Z)="
":K1=1:RETURN
2360 NEXT:GOTO2350
2370 E$(X,Y)=IR$:RETURN
2380 '*** ABILITY BONUS ***
2390 FORX=1TOXX:EM(X)=1
2400 IFS(X)>15ANDC$(X)="FIGHTER"THENEM(X)=1.1
2410 IFS(X)>15ANDW(X)>15ANDC$(X)="PALADIN"THENEM(X)=1.1
2420 IFS(X)>15ANDW(X)>15ANDI(X)>15ANDC$(X)="RANGER"THENEM(X)=1.1
2430 IFW(X)>15ANDC$(X)="CLERIC"THENEM(X)=1.1
2440 IFW(X)>15ANDR(X)>15ANDC$(X)="DRUID"THENEM(X)=1.1
2450 IFI(X)>15ANDC$(X)="MAGICIAN"THENEM(X)=1.1
2460 IFD(X)>15ANDC$(X)="THIEF"THENEM(X)=1.1
2470 NEXT:FORX=1TOXX:ET=ET+EM(X):NEXT:RETURN
2480 '*** EXPERIENCE/LEVEL ***
2490 IFC$(X)="MAGICIAN"THENE1=625:E2=2.01:HD(X)=4
2500 IFC$(X)="ILLUSIONIST"THENE1=560:E2=1.99:HD(X)=4
2510 IFC$(X)="CLERIC"THENE1=375:E2=2.03:HD(X)=8
2520 IFC$(X)="DRUID"THENE1=500:E2=1.9:HD(X)=8
2530 IFC$(X)="FIGHTER"THENE1=500:E2=2.04:HD(X)=10
2540 IFC$(X)="PALADIN"THENE1=690:E2=2.02:HD(X)=10
2550 IFC$(X)="RANGER"THENE1=560:E2=2.03:HD(X)=8
2560 IFC$(X)="THIEF"THENE1=312:E2=2.01:HD(X)=6
2570 IFC$(X)="ASSASSIN"THENE1=375:E2=2.01:HD(X)=6
2580 IFC$(X)="MONK"THENE1=560:E2=2.08:HD(X)=4
2590 IFC(X)=15THENCB=1
2600 IFC(X)>15THENCB=2
2610 IFC(X)=17AND(C$(X)="FIGHTER"ORC$(X)="PALADIN"ORC$(X)="RANGER")THENCB=3
2620 IFC(X)=18AND(C$(X)="FIGHTER"ORC$(X)="PALADIN"ORC$(X)="RANGER")THENCB=4
2630 IFC(X)<15THENCB=0
2640 NH=0:NL(X)=INT(LOG(E(X)/E1)/LOG(E2)):IFNL(X)>L(X)THENNH=RND(HD(X))
2650 IFNL(X)-L(X)=1THENL(X)=NL(X):GOTO2680ELSEIFNL(X)<L(X)THEN2680
2660 IFNL(X)-L(X)>2THENE(X)=INT((E2^(L(X)+2))*E1-1)
2670 L(X)=L(X)+1:PRINT" EXCESS EXPERIENCE POINTS GAINED"
2680 PRINT" PRESENT LEVEL";L(X):PRINT" EXP. POINTS";E(X):RETURN
2690 '*****SAVE CHARACTERS*****
2700 CLS:PRINT@101,"*DO YOU WISH TO SAVE*":PRINT@135,"*THESE CHARACTERS*":PRINT@
206,"(Y/N)"

2710 GOSUB60:IFK$="N"THENEND
2720 PRINT:PRINT" THE CHARACTERS WILL BE SAVED     IN SEPARATE FILES TO ALLOW
  THEM TO ADVENTURE IN DIFFERENT  GROUPS.":PRINT@417,"PREPARE TAPE.":PRINT" THEN
 PRESS ANY KEY.....":GOSUB60
2730 FORX=1TOXX:IFH(X)<1THEN2775ELSECLS:PRINT@228,"**SAVING**":PRINT@238,N$(X);"
**":OPEN"O",#-1,N$(X)
2740 PRINT#-1,N$(X),R$(X),C$(X),L(X),S(X),I(X),W(X),C(X),D(X),R(X),B$(X),GP(X),H
P(X),SB(X),DB(X),WA(X),W1$(X),W2$(X),W3$(X)
2750 PRINT#-1,A$(X),AC(X),LI(X),E(X),G(X)
2760 FORY=1TO8:PRINT#-1,E$(X,Y),S$(X,Y):NEXTY:FORY=1TO5:PRINT#-1,T$(X,Y):NEXTY
2770 CLOSE#-1:CLS:PRINT@228,"**";N$(X);:PRINT"**SAVED**":PRINT@417,"PRESS ANY KE
Y TO SAVE NEXT       CHARACTER.":GOSUB60
2775 NEXTX:RETURN
2780 '* LOAD ADVENTURE *
2790 CLS:PRINT@33,"PART III :THE TAVERN.":PRINT@97,"THIS PROGRAM ALLOWS YOU TO
    DIVIDE THE SPOILS FROM YOUR       LAST ADVENTURE."2800 PRINT@257,"PREPARE TO L
OAD YOUR PREVIOUSLY SAVED ADVENTURE.THEN PRESS ANY  KEY.":GOSUB60:CLS:PRINT@234,
"* LOADING *":PRINT@266,"* DUNGEON *"
2810 OPEN"I",#-1,"DUNGEON":INPUT#-1,XX:FORX=1TOXX
2820 INPUT#-1,N$(X),R$(X),C$(X),L(X),S(X),I(X),W(X),C(X),D(X),R(X),B$(X),GP(X),H
P(X),SB(X),DB(X),WA(X),W1$(X),W2$(X),W3$(X)
2830 INPUT#-1,A$(X),AC(X),LI(X),E(X),Q(X),G(X),H(X),A(X),WE(X)
2840 FORY=1TO8:INPUT#-1,E$(X,Y),S$(X,Y):NEXTY:FORY=1TO5:INPUT#-1,T$(X,Y):NEXTY,X
:INPUT#-1,MT,R,L,CC
2850 CLOSE#-1:RETURN
2860 '** CHARACTER DISPLAY **
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2870 CLS:PRINTN$(X);",";R$(X);" ";C$(X);"(LEVEL";L(X);")"
2880 PRINT@64,"STRENGTH":PRINT@96,"INTELLIGENCE":PRINT@128,"WISDOM"
2890 PRINT@160,"CONSTITUTION":PRINT@192,"DEXTERITY":PRINT@224,"CHARISMA"
2900 IFS(X)>18THENS(X)=18
2910 IFI(X)>18THENI(X)=18
2920 IFW(X)>18THENW(X)=18
2930 IFC(X)>18THENC(X)=18
2940 IFD(X)>18THEND(X)=18
2950 IFR(X)>18THENR(X)=18
2960 PRINT@78,"";:PRINTUSING"##";S(X):PRINT@110,"";:PRINTUSING"##";I(X):PRINT@14
2,"";:PRINTUSING"##";W(X)
2970 PRINT@174,"";:PRINTUSING"##";C(X):PRINT@206,"";:PRINTUSING"##";D(X):PRINT@2
38,"";:PRINTUSING"##";R(X)
2980 IFS(X)>17THENPRINT@80,"/";B$(X)
2990 PRINT@114,"GOLD";GP(X);"GP":PRINT@146,"BASIC";HP(X);"HP":PRINT@178,"HIT@ +"
;BB(X)
3000 PRINT@210,"DAMAGE@ +";DB(X):PRINT@242,"CARRY";WA(X):PRINT@256,"*WEAPONS* ";
W1$(X):PRINT@298,W2$(X);"  ";W3$(X)
3010 PRINT@320,"*ARMOUR* ";A$(X);"(AC";AC(X);")":PRINT@352,"*EQUIPMENT* ";:FORY=
1TO8:IFE$(X,Y)=""THEN3030
3020 PRINTE$(X,Y);",";
3030 NEXT:GOSUB60:CLS:PRINT@40,"*SPELLS*":PRINT:FORY=1TO8:PRINTY;S$(X,Y):NEXT:GO
SUB60:RETURN
3040 FORX=1TO66:READTF$(X),EV(X):NEXT:FORX=1TO66:READWC(X):NEXT:RETURN
3050 DATA POTION...OF HEALING,100,SCROLL...OF CURE LIGHT WOUNDS,100,SCROLL...OF
eNTANGLE,100,SCROLL...OF mAGIC MISSILE,100
3060 DATA SCROLL...OF CHARM PERSON,100,SCROLL...OF sLEEP,100,SCROLL...OF COLOUR
SPRAy,100,RING.....OF wARMTH,500,WAND.....OF mAGIC MISSILES,4000
3070 DATA CHAINMAIL+1,600,SHIELD...+1,250,SWORD....+1,400,AXE......+1,300,DAGGER
...+1,100,MACE....+1,350
3080 DATA POTION...OF EXTRA-HEALING,200,SCROLL...OF hOLD PERSON,200,SCROLL...OF
INvULNERABILITY,350,SCROLL... OF bLINDNESS,-200,RING.....OF iNVISIBILITY,1500,CL
OAK....OF PROTECTION+1,1000
3090 DATA DAGGER...+2,200,SWORD....+2,800,AMULET OF GOLD & PLATINUM,5000,BAG....
.OF DEVOURING,-1
3100 DATA POTION...OF iNVISIBILITY,250,SCROLL...OF CALL lIGHTNING,200,SCROLL...O
F iNVISIBILITY,250,SCROLL...OF PARALYzATION,300,RING.....OF PROTECTION+1,3000,WA
ND.....OF fIRE,4500
3110 DATA CHAINMAIL+2,1200,SHIELD...+2,500,AXE.....+2,600,SPEAR....+2,1000,RED P
EARL,500,SAPPHIRE,500
3120 DATA POTION...OF INvULNERABILITY,350,SCROLL...OF CURE DISEASE,300,SCROLL...
OF StRENGTH,300,SCROLL...OF lIGTHNING BOLT,200,SCROLL...OF fIREBALL,300,SCROLL..
.OF cHAOS,500,WAND.....OF FEAr,3000
3130 DATA PLATEMAIL+1,800,SWORD....+3,1400,EMERALD,500,STAR RUBY,500
3140 DATA POTION...OF gIANT STRENGTH,650,SCROLL...OF RAISE DEAD,500,SCROLL...OF
WALL OF fIRE,400,SCROLL...OF ICE SToRM,400,RING.....OF FEATHER FALL,1000,WAND...
..OF STRIKInG,6000
3150 DATA AXE......+3,1000,DAGGER...+3,300,MACE.....+2,700,FIRE OPAL,500,DIAMOND
,500
3160 DATA POTION...OF dRAGON CONTROL,800,SCROLL...OF cONFUSION,900,SCROLL...OF D
EATH SPELL(x),900,RING.....OF REGENERATION,5000,PLATEMAIL+2,1800,MOONSTONE,500,C
ROWN OF GOLD,8080
3170 DATA 1,7,5,2,2,2,3,1,1,8,8,9,6,14,8,1,10,2,4,1,1,14,9,1,1,1
3180 DATA 11,12,3,1,2,8,8,6,13,1,1,6,7,2,11,2,3,10,8,9,1,1,6,4
3190 DATA 5,2,1,10,6,14,8,1,1,1,5,2,1,8,1,1
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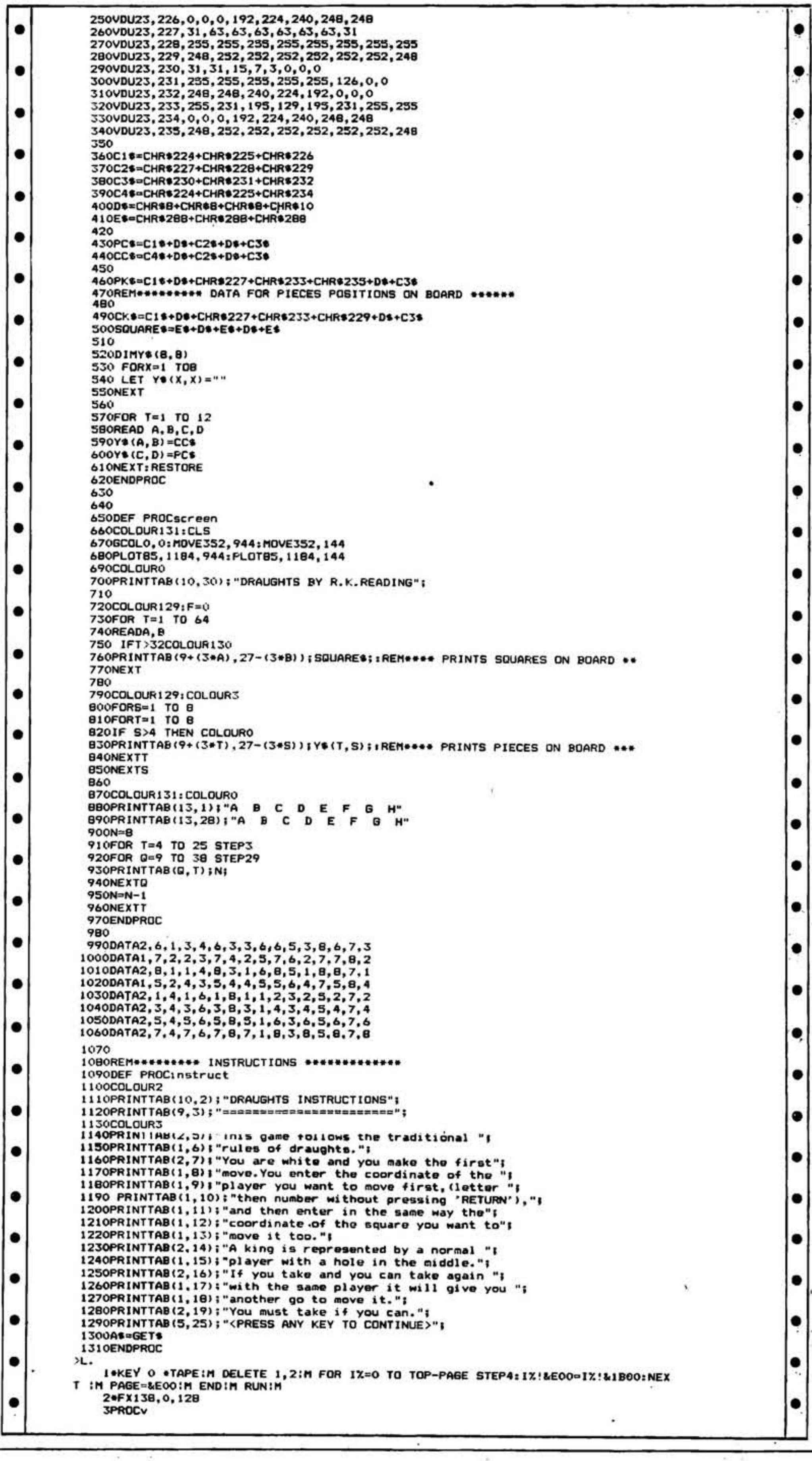
BBC Draughts

by R K Reading

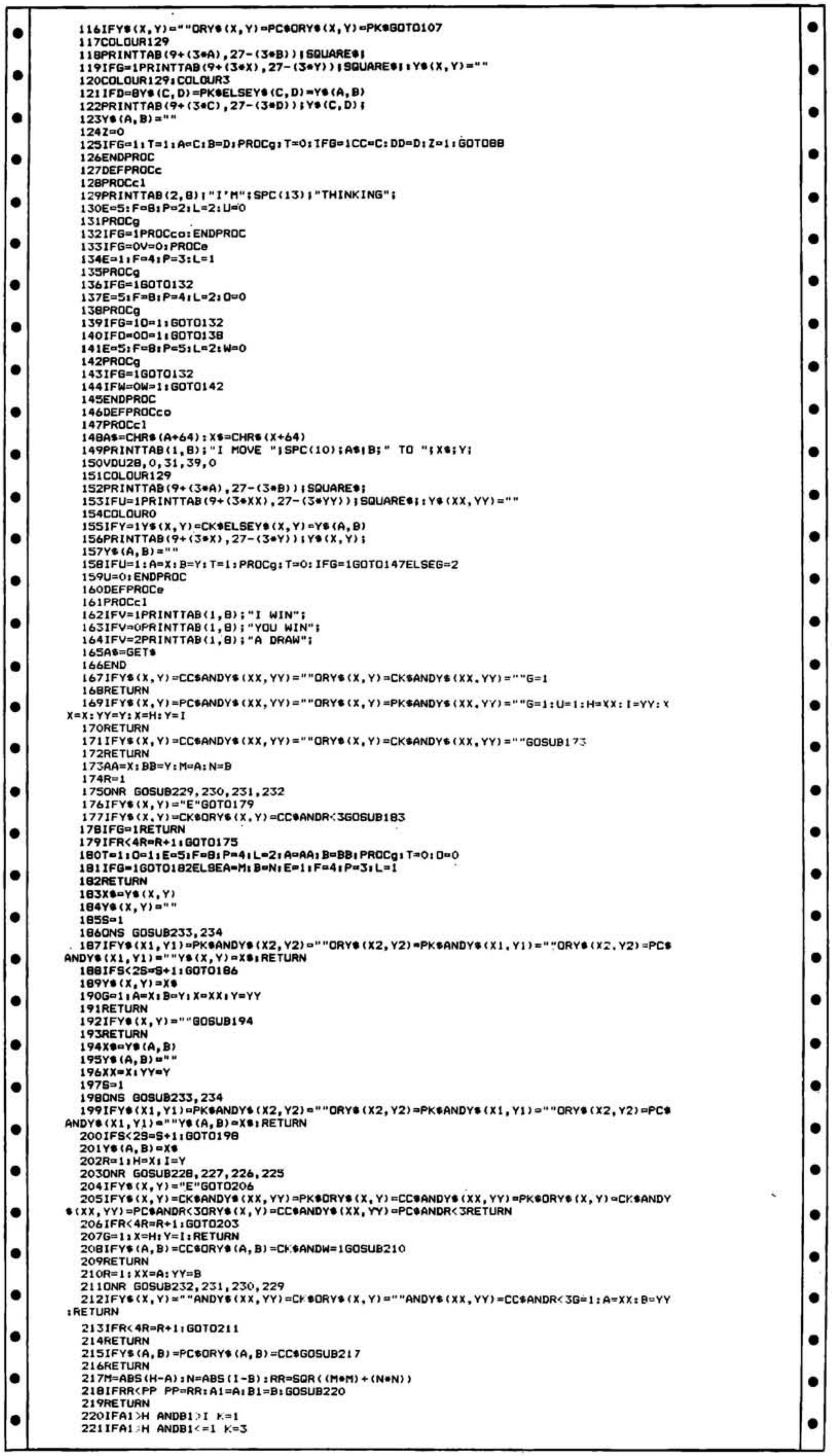
Strategy games using Basic normally result in either a nice graphics screen demanding little game skill or a boring display requiring skill and expertise. This version of draughts for the BBC combines the best of both worlds: the display is clear and colourful, and it's an excellent game.

The program is in two parts: type in listing one and save it as a file called 'D1', then type in listing two and save is as a file called 'D2'. When D1 is run it will automatically load D2. The second listing is a very tight squeeze in 32k, so it is absolutely *essential* that the program is typed in as printed with no extra spaces and that the line number increases by 1. Instructions are included in the program as long as you are familiar with the rules of draughts. Good luck: it plays a mean game.

```
>L.
   10REM*****************************
   15REM******          *********
   20REM******* DRAUGHTS  *********
   30REM*******   BY      *********
   40REM******* R.K.READING *********
   50REM******          *********
   60REM*****************************
   70MODE1
   80VDU23;8202;0;0;0;
   90VDU19,2,2,0,0,0
  100
  110REM********* MAIN PROGRAM *****
  120
  130PROCinstruct
  140PROCvar
  150PROCscreen
  160VDU28,0,31,8,0
  170COLOUR3
  180CHAIN"D2"
  190
  200REM******* SET UP VARIABLES ****
  210
  220DEFPROCvar
  230VDU23,224,0,0,0,3,7,15,31,31
  240VDU23,225,0,0,126,255,255,255,255,255
```



```
 250VDU23,226,0,0,0,192,224,240,248,248
 260VDU23,227,31,63,63,63,63,63,63,31
 270VDU23,228,255,255,255,255,255,255,255,255
 280VDU23,229,248,252,252,252,252,252,252,248
 290VDU23,230,31,31,15,7,3,0,0,0
 300VDU23,231,255,255,255,255,255,126,0,0
 310VDU23,232,248,248,240,224,192,0,0,0
 320VDU23,233,255,231,195,129,195,231,255,255
 330VDU23,234,0,0,0,192,224,240,248,248
 340VDU23,235,248,252,252,252,252,252,252,248
 350
 360C1$=CHR$224+CHR$225+CHR$226
 370C2$=CHR$227+CHR$228+CHR$229
 380C3$=CHR$230+CHR$231+CHR$232
 390C4$=CHR$224+CHR$225+CHR$234
 400D$=CHR$8+CHR$8+CHR$8+CHR$10
 410E$=CHR$288+CHR$288+CHR$288
 420
 430PC$=C1$+D$+C2$+D$+C3$
 440CC$=C4$+D$+C2$+D$+C3$
 450
 460PK$=C1$+D$+CHR$227+CHR$233+CHR$235+D$+C3$
 470REM********* DATA FOR PIECES POSITIONS ON BOARD ******
 480
 490CK$=C1$+D$+CHR$227+CHR$233+CHR$229+D$+C3$
 500SQUARE$=E$+D$+E$+D$+E$
 510
 520DIMY$(8,8)
 530 FORX=1 TO8
 540 LET Y$(X,X)=""
 550NEXT
 560
 570FOR T=1 TO 12
 580READ A,B,C,D
 590Y$(A,B)=CC$
 600Y$(C,D)=PC$
 610NEXT:RESTORE
 620ENDPROC
 630
 640
 650DEF PROCscreen
 660COLOUR131:CLS
 670GCOL0,0:MOVE352,944:MOVE352,144
 680PLOT85,1184,944:PLOT85,1184,144
 690COLOUR0
 700PRINTTAB(10,30);"DRAUGHTS BY R.K.READING";
 710
 720COLOUR129:F=0
 730FOR T=1 TO 64
 740READA,B
 750 IFT>32COLOUR130
 760PRINTTAB(9+(3*A),27-(3*B));SQUARE$;:REM**** PRINTS SQUARES ON BOARD **
 770NEXT
 780
 790COLOUR129:COLOUR3
 800FORS=1 TO 8
 810FORT=1 TO 8
 820IF S>4 THEN COLOUR0
 830PRINTTAB(9+(3*T),27-(3*S));Y$(T,S);:REM**** PRINTS PIECES ON BOARD ***
 840NEXTT
 850NEXTS
 860
 870COLOUR131:COLOUR0
 880PRINTTAB(13,1);"A  B  C  D  E  F  G  H"
 890PRINTTAB(13,28);"A  B  C  D  E  F  G  H"
 900N=8
 910FOR T=4 TO 25 STEP3
 920FOR Q=9 TO 38 STEP29
 930PRINTTAB(Q,T);N;
 940NEXTQ
 950N=N-1
 960NEXTT
 970ENDPROC
 980
 990DATA2,6,1,3,4,6,3,3,6,6,5,3,8,6,7,3
1000DATA1,7,2,2,3,7,4,2,5,7,6,2,7,7,8,2
1010DATA2,8,1,1,4,8,3,1,6,8,5,1,8,8,7,1
1020DATA1,5,2,4,3,5,4,4,5,5,6,4,7,5,8,4
1030DATA2,1,4,1,6,1,8,1,1,2,3,2,5,2,7,2
1040DATA2,3,4,3,6,3,8,3,1,4,3,4,5,4,7,4
1050DATA2,5,4,5,6,5,8,5,1,6,3,6,5,6,7,6
1060DATA2,7,4,7,6,7,8,7,1,8,3,8,5,8,7,8
1070
1080REM********* INSTRUCTIONS *************
1090DEF PROCinstruct
1100COLOUR2
1110PRINTTAB(10,2);"DRAUGHTS INSTRUCTIONS";
1120PRINTTAB(9,3);"=======================";
1130COLOUR3
1140PRINTTAB(2,5);"This game follows the traditional ";
1150PRINTTAB(1,6);"rules of draughts.";
1160PRINTTAB(2,7);"You are white and you make the first";
1170PRINTTAB(1,8);"move.You enter the coordinate of the ";
1180PRINTTAB(1,9);"player you want to move first,(letter ";
1190 PRINTTAB(1,10);"then number without pressing 'RETURN'),";
1200PRINTTAB(1,11);"and then enter in the same way the";
1210PRINTTAB(1,12);"coordinate of the square you want to";
1220PRINTTAB(1,13);"move it too.";
1230PRINTTAB(2,14);"A king is represented by a normal ";
1240PRINTTAB(1,15);"player with a hole in the middle.";
1250PRINTTAB(2,16);"If you take and you can take again ";
1260PRINTTAB(1,17);"with the same player it will give you ";
1270PRINTTAB(1,18);"another go to move it.";
1280PRINTTAB(2,19);"You must take if you can.";
1290PRINTTAB(5,25);"<PRESS ANY KEY TO CONTINUE>";
1300A$=GET$
1310ENDPROC
>L.
    1*KEY 0 *TAPE:M DELETE 1,2:M FOR I%=0 TO TOP-PAGE STEP4:I%!&E00=I%!&1B00:NEX
T :M PAGE=&E00:M END:M RUN:M
    2*FX138,0,128
    3PROCv
 4E=1:F=4:P=1:L=1:Z=0:PROCg
 5IFG=1ORG=2GOTO9
 6IF DR=0V=1:GOTO14
 7IF DR=1 E=5:F=8:P=4:L=2:PROCg
 8IFG=1ORG=2THENV=1ELSEV=2:GOTO14
 9PROCp:PROCc
10IFG=1ORG=2GOTO4
11IF DR=0V=0:GOTO14
12IF DR=1 E=1:F=4:P=1:L=1:PROCg
13IFG=1ORG=2THENV=0ELSEV=2:GOTO14
14PROCe
15DEFPROCv
16C1$=CHR$224+CHR$225+CHR$226
17C2$=CHR$227+CHR$228+CHR$229
18C3$=CHR$230+CHR$231+CHR$232
19C4$=CHR$224+CHR$225+CHR$234
20D$=CHR$8+CHR$8+CHR$8+CHR$10
21E$=CHR$288+CHR$288+CHR$288
22PC$=C1$+D$+C2$+D$+C3$
23CC$=C4$+D$+C2$+D$+C3$
24PK$=C1$+D$+CHR$227+CHR$233+CHR$235+D$+C3$
25CK$=C1$+D$+CHR$227+CHR$233+CHR$229+D$+C3$
26SQUARE$=E$+D$+E$+D$+E$
27DIMY$(9,9)
28FORX=0TO9
29FORY=0TO9
30IFX<1ORX>8ORY<1ORY>8Y$(X,Y)="E"ELSEY$(X,Y)=""
31NEXT:NEXT
32FORT=1TO12
33READA,B,C,D
34Y$(A,B)=CC$:Y$(C,D)=PC$
35NEXT
36Q=0:T=0:O=1
37ENDPROC
38DATA2,6,1,3,4,6,3,3,6.6,5,3,8,6,7,3
39DATA1,7,2,2,3,7,4,2,5,7,6,2,7,7,8,2
40DATA2,8,1,1,4,8,3,1,6,8,5,1,8,8,7,1
41DATA1,5,2,4,3,5,4,4,5,5,6,4,7,5,8,4
42DATA2,1,4,1,6,1,8,1,1,2,3,2,5,2,7,2
43DATA2,3,4,3,6,3,8,3,1.4,3,4,5,4,7,4
44DATA2,5,4.5,6,5,8,5,1,6,3,6,5,6,7,6
45DATA2,7,4,7,6,7,8,7,1.8,3,8,5,8.7,8
46DEFPROCi
47PROCcl
48PRINTTAB(1,8);"ILLEGAL";
49PRINTTAB(3,10);"MOVE";
50FORJ=1TO1000:NEXT:CLS
51VDU28,0,31,39,0:ENDPROC
52DEFPROCpr
53PROCcl
54PRINTTAB(4,8);"YOU";SPC(6);"MUST";SPC(5);"TAKE";
55FORJ=1TO1000:NEXT:CLS
56ENDPROC
57DEFPROCcl
58COLOUR131:COLOUR0
59VDU28,0,31,8,0
60CLS
61ENDPROC
62DEFPROCg
63G=0:DR=0
64IFT=1GOTO73
65A=1:B=1
66IFQ=0ANDP=4A=RND(3):A=A+A:B=6
67IFL=1ANDY$(A,B)=PC$ORL=1ANDY$(A,B)=PK$GOTO73
68IFL=2ANDY$(A,B)=CC$ORL=2ANDY$(A,B)=CK$GOTO73
69IFQ=0ANDP=4GOTO66
70IFA=8B=B+1:A=0
71IFB<9A=A+1:GOTO67
72ENDPROC
73K=E:DR=1
74IFY$(A,B)=CK$ANDO=0AA=A:BB=B:K=0:PP=10:P=6:L=1:PROCg:P=4:L=2:A=AA:B=BB
75IFK=0GOTO70
76ONK GOSUB225,226,227,228,228,227,226,225
77IFF-K<=1ANDY$(A,B)=PC$ORF-K<=1ANDY$(A,B)=CC$GOTO85
78IFX>8ORX<1ORY>8ORY<1GOTO84
79ONP GOSUB167,169,171,192,208,215
80IFQ=0ANDG=1ANDP=4Q=1
81IFG=1ENDPROC
82IFY$(X,Y)=""G=2
83IFO=0ANDY$(A,B)=CK$GOTO70
84IFK<F THENK=K+1:GOTO76
85IFT=1ENDPROC
86GOTO69
87DEFPROCp
88PROCcl
89VDU28,0,31,39,0
90*FX21,0
91PRINTTAB(1,4);"YOUR GO";
92A$=GET$:A=ASC(A$)-64
93PRINTTAB(2,6);A$;
94B=GET:B=B-48
95PRINTTAB(3,6);B;
96C$=GET$:C=ASC(C$)-64
97PRINTTAB(5,6);C$;
98D=GET:D=D-48
99PRINTTAB(6,6);D;
100IFZ=0GOTO102
101IFA=CC ANDB=DD GOTO102ELSEPROCpr:GOTO88
102IFC<1ORC>8ORD<1ORD>8ORA<1ORA>8ORB<1ORB>8PROCi:GOTO91
103M=ABS(A-C)
104N=ABS(B-D)
105IFY$(A,B)=PC$ANDB>D GOTO107
106IFM=1ANDN=1ORM=2ANDN=2GOTO108
107PROCi:GOTO91
108IFY$(A,B)=PC$ANDY$(C,D)=""ORY$(A,B)=PK$ANDY$(C,D)=""GOTO110
109GOTO107
110IFM=2GOTO113
111IFG=1PROCpr:GOTO88
112GOTO117
113M=A-C:N=B-D
114X=A-SGN(M)
115Y=B-SGN(N)
```



```
116IFY$(X,Y)=""ORY$(X,Y)=PC$ORY$(X,Y)=PK$GOTO107
117COLOUR129
118PRINTTAB(9+(3*A),27-(3*B));SQUARE$;
119IFG=1PRINTTAB(9+(3*X),27-(3*Y));SQUARE$;:Y$(X,Y)=""
120COLOUR129:COLOUR3
121IFD=8Y$(C,D)=PK$ELSEY$(C,D)=Y$(A,B)
122PRINTTAB(9+(3*C),27-(3*D));Y$(C,D);
123Y$(A,B)=""
124Z=0
125IFG=1:T=1:A=C:B=D:PROCg:T=0:IFG=1CC=C:DD=D:Z=1:GOTO88
126ENDPROC
127DEFPROCc
128PROCcl
129PRINTTAB(2,8);"I'M";SPC(13);"THINKING";
130E=5:F=8:P=2:L=2:U=0
131PROCg
132IFG=1PROCco:ENDPROC
133IFG=0V=0:PROCe
134E=1:F=4:P=3:L=1
135PROCg
136IFG=1GOTO132
137E=5:F=8:P=4:L=2:O=0
138PROCg
139IFG=1O=1:GOTO132
140IFO=0O=1:GOTO138
141E=5:F=8:P=5:L=2:W=0
142PROCg
143IFG=1GOTO132
144IFW=0W=1:GOTO142
145ENDPROC
146DEFPROCco
147PROCcl
148A$=CHR$(A+64):X$=CHR$(X+64)
149PRINTTAB(1,8);"I MOVE ";SPC(10);A$;B;" TO ";X$;Y;
150VDU28,0,31,39,0
151COLOUR129
152PRINTTAB(9+(3*A),27-(3*B));SQUARE$;
153IFU=1PRINTTAB(9+(3*XX),27-(3*YY));SQUARE$;:Y$(XX,YY)=""
154COLOUR0
155IFY=1Y$(X,Y)=CK$ELSEY$(X,Y)=Y$(A,B)
156PRINTTAB(9+(3*X),27-(3*Y));Y$(X,Y);
157Y$(A,B)=""
158IFU=1:A=X:B=Y:T=1:PROCg:T=0:IFG=1GOTO147ELSEG=2
159U=0:ENDPROC
160DEFPROCe
161PROCcl
162IFV=1PRINTTAB(1,8);"I WIN";
163IFV=0PRINTTAB(1,8);"YOU WIN";
164IFV=2PRINTTAB(1,8);"A DRAW";
165A$=GET$
166END
167IFY$(X,Y)=CC$ANDY$(XX,YY)=""ORY$(X,Y)=CK$ANDY$(XX,YY)=""G=1
168RETURN
169IFY$(X,Y)=PC$ANDY$(XX,YY)=""ORY$(X,Y)=PK$ANDY$(XX,YY)=""G=1:U=1:H=XX:I=YY:X
X=X:YY=Y:X=H:Y=I
170RETURN
171IFY$(X,Y)=CC$ANDY$(XX,YY)=""ORY$(X,Y)=CK$ANDY$(XX,YY)=""GOSUB173
172RETURN
173AA=X:BB=Y:M=A:N=B
174R=1
175ONR GOSUB229,230,231,232
176IFY$(X,Y)="E"GOTO179
177IFY$(X,Y)=CK$ORY$(X,Y)=CC$ANDR<3GOSUB183
178IFG=1RETURN
179IFR<4R=R+1:GOTO175
180T=1:O=1:E=5:F=8:P=4:L=2:A=AA:B=BB:PROCg:T=0:O=0
181IFG=1GOTO182ELSEA=M:B=N:E=1:F=4:P=3:L=1
182RETURN
183X$=Y$(X,Y)
184Y$(X,Y)=""
185S=1
186ONS GOSUB233,234
187IFY$(X1,Y1)=PK$ANDY$(X2,Y2)=""ORY$(X2,Y2)=PK$ANDY$(X1,Y1)=""ORY$(X2,Y2)=PC$
ANDY$(X1,Y1)=""Y$(X,Y)=X$:RETURN
188IFS<2S=S+1:GOTO186
189Y$(X,Y)=X$
190G=1:A=X:B=Y:X=XX:Y=YY
191RETURN
192IFY$(X,Y)=""GOSUB194
193RETURN
194X$=Y$(A,B)
195Y$(A,B)=""
196XX=X:YY=Y
197S=1
198ONS GOSUB233,234
199IFY$(X1,Y1)=PK$ANDY$(X2,Y2)=""ORY$(X2,Y2)=PK$ANDY$(X1,Y1)=""ORY$(X2,Y2)=PC$
ANDY$(X1,Y1)=""Y$(A,B)=X$:RETURN
200IFS<2S=S+1:GOTO198
201Y$(A,B)=X$
202R=1:H=X:I=Y
203ONR GOSUB228,227,226,225
204IFY$(X,Y)="E"GOTO206
205IFY$(X,Y)=CK$ANDY$(XX,YY)=PK$ORY$(X,Y)=CC$ANDY$(XX,YY)=PK$ORY$(X,Y)=CK$ANDY
$(XX,YY)=PC$ANDR<3ORY$(X,Y)=CC$ANDY$(XX,YY)=PC$ANDR<3RETURN
206IFR<4R=R+1:GOTO203
207G=1:X=H:Y=I:RETURN
208IFY$(A,B)=CC$ORY$(A,B)=CK$ANDW=1GOSUB210
209RETURN
210R=1:XX=A:YY=B
211ONR GOSUB232,231,230,229
212IFY$(X,Y)=""ANDY$(XX,YY)=CK$ORY$(X,Y)=""ANDY$(XX,YY)=CC$ANDR<3G=1:A=XX:B=YY
:RETURN
213IFR<4R=R+1:GOTO211
214RETURN
215IFY$(A,B)=PC$ORY$(A,B)=CC$GOSUB217
216RETURN
217M=ABS(H-A):N=ABS(I-B):RR=SQR((M*M)+(N*N))
218IFRR<PP PP=RR:A1=A:B1=B:GOSUB220
219RETURN
220IFA1>H ANDB1>I K=1
221IFA1>H ANDB1<=1 K=3
```

```
222IFA1<H ANDB1<=I K=4
223IFA1<=H ANDB1>I K=2
224RETURN
225X=A+1:Y=B+1:XX=A+2:YY=B+2:RETURN
226X=A-1:Y=B+1:XX=A-2:YY=B+2:RETURN
227X=A+1:Y=B-1:XX=A+2:YY=B-2:RETURN
228X=A-1:Y=B-1:XX=A-2:YY=B-2:RETURN
229X=XX-1:Y=YY+1:RETURN
230X=XX+1:Y=YY+1:RETURN
231X=XX-1:Y=YY-1:RETURN
232X=XX+1:Y=YY-1:RETURN
233X1=XX+1:Y1=YY+1:X2=XX-1:Y2=YY-1:RETURN
234X1=XX-1:Y1=YY+1:X2=XX+1:Y2=YY-1:RETURN
```

TRS-80 Adventure Parsers

by Alan Kirk

Possibly the only redeeming feature of the outdated TRS-80 is the quality of its Basic: in particular the writing of text adventures is suited to this machine — typically a 48k adventure on the Spectrum would occupy, say, 32k on a TRS-80 and run much faster. This machine code utility will further improve the quality of any adventures written on a TRS-80 or System 80.

The program decodes sentences of the usual verb-noun format with the first three letters of each word being significant. To use the program in your own adventure you must use the code from 10 to 120 and the data from 140 to 490. You *can* use different line numbering, but 'LN' in line 30 *must* contain the line number of the first data statement.

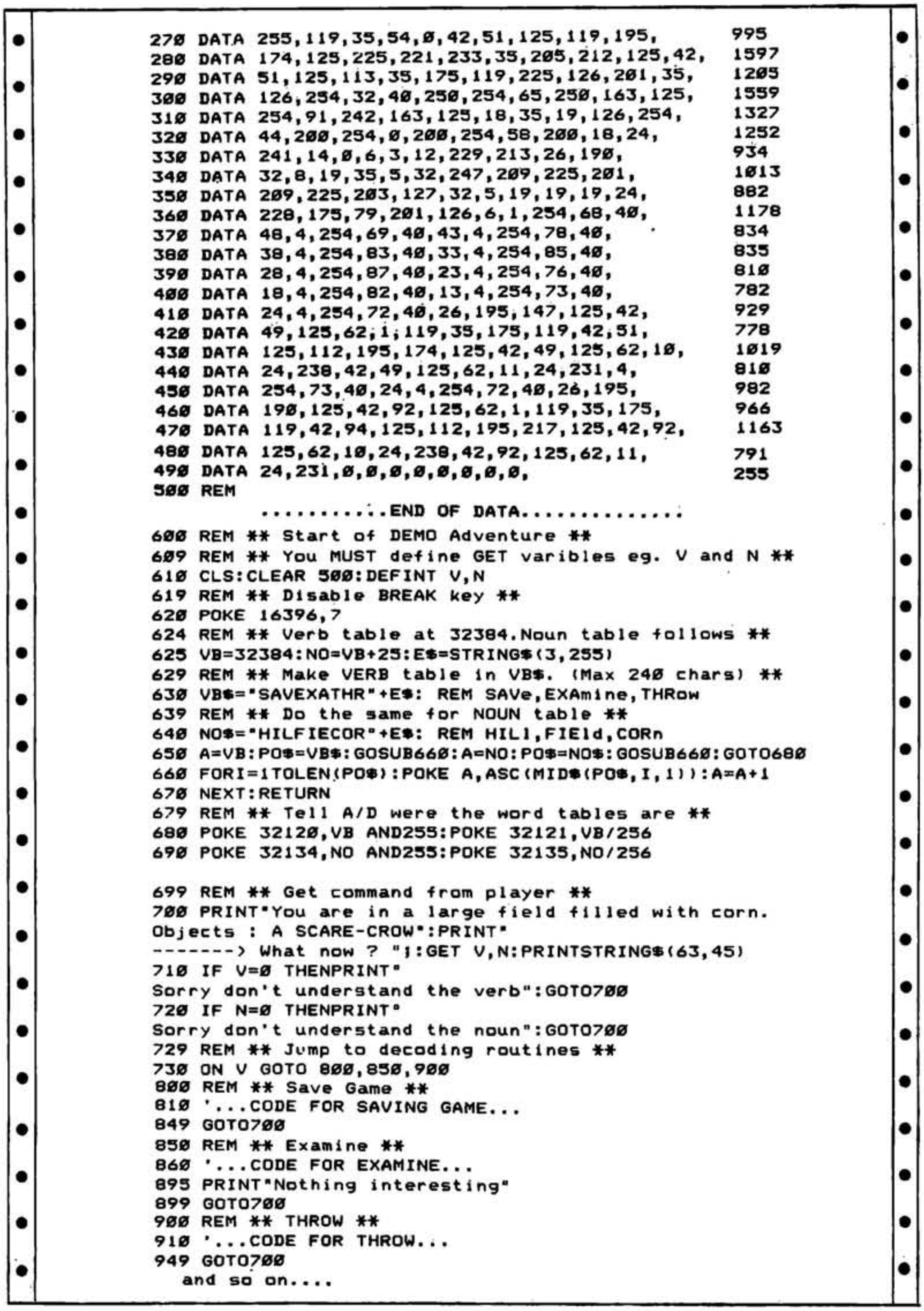
To initialise the adventure decoder you need lines 600 to 690 with the strings VB$ and NO$ initialised to lists of three-character words. The decoder can then be used by inserting 'GET V,N' at the point in your program where you require sentence input. Any two variables can be used, but they must be defined as integers. The two numbers returned represent the position of the verb and noun on their own, so they can be tested for actions.

The length of the word table is limited to 249 characters which correspond to 83 words. If any one of the returned values is 255, then the word is not in one of the tables.

The common one-letter commands are pre-programmed into the routine and will respond as follows:

Command Entered	*V*	*N*	
D	1	1	(Down)
E	1	2	(East)
N	1	3	(North)
S	1	4	(South)
U	1	5	(Up)
W	1	6	(West)
L	1	7	(Left)
R	1	8	(Right)
H	11	10	(Help)
I	10	9	(Inventory)

```
5 REM  +++++++++++++++++++++++++++++++++++
       + Adventure Decoder For TRS-80    +
       +          By Alan Kirk           +
       +                                 +
       + 19/10/84            Version 1.2 +
6 REM  +++++++++++++++++++++++++++++++++++


10 CLS:CLEAR 100:DEFINT A-Z
20 PRINT"*** Adventure Decoder ***
Poking in data from line:"
30 A=32021:LN=140:RESTORE:FOR L=1 TO 36
40 CV=0:CK=0:FOR I=1 TO 10:READ A(I):CK=CK+A(I):NEXT
50 READ CV:IFCK<>CVTHENPRINT"Data error in line:";LN:END
60 FOR I=1 TO 10:POKE A,A(I):A=A+1:NEXTI
70 PRINT@89,LN;:LN=LN+10
80 NEXT L
90 REM ** Set up 'GET' vector in RAM **
100 POKE 16767,195:POKE 16768,53:POKE 16769,125
110 REM ** Activate Adventure Decoder **
120 POKE 16526,21:POKE 16527,125:X=USR(0)
130 REM

          ............DATA.....................   CHECKSUM

140 DATA 221,42,128,65,33,53,125,34,128,65,        894
150 DATA 33,4,125,34,177,64,0,0,0,0,               437
160 DATA 0,0,0,0,0,0,0,0,0,201,                    201
170 DATA 0,0,17,37,125,205,181,125,254,44,         988
180 DATA 32,101,175,18,17,43,125,35,205,181,       932
190 DATA 125,254,58,40,4,254,0,32,84,229,          1080
200 DATA 175,18,33,37,125,205,13,38,237,83,        964
210 DATA 49,125,33,43,125,205,13,38,237,83,        951
220 DATA 51,125,33,5,125,6,16,205,217,5,           788
230 DATA 56,246,120,254,1,202,245,125,17,21,       1287
240 DATA 252,229,205,212,125,42,49,125,113,35,     1387
250 DATA 175,119,17,98,253,225,6,12,35,126,        1066
260 DATA 254.32.40.21,16,248,42,49,125,62,         889
```



```
270 DATA 255,119,35,54,0,42,51,125,119,195,      995
280 DATA 174,125,225,221,233,35,205,212,125,42,  1597
290 DATA 51,125,113,35,175,119,225,126,201,35,   1205
300 DATA 126,254,32,40,250,254,65,250,163,125,   1559
310 DATA 254,91,242,163,125,18,35,19,126,254,    1327
320 DATA 44,200,254,0,200,254,58,200,18,24,      1252
330 DATA 241,14,0,6,3,12,229,213,26,190,         934
340 DATA 32,8,19,35,5,32,247,209,225,201,        1013
350 DATA 209,225,203,127,32,5,19,19,19,24,       882
360 DATA 228,175,79,201,126,6,1,254,68,40,       1178
370 DATA 48,4,254,69,40,43,4,254,78,40,          834
380 DATA 38,4,254,83,40,33,4,254,85,40,          835
390 DATA 28,4,254,87,40,23,4,254,76,40,          810
400 DATA 18,4,254,82,40,13,4,254,73,40,          782
410 DATA 24,4,254,72,40,26,195,147,125,42,       929
420 DATA 49,125,62;1;119,35,175,119,42;51,       778
430 DATA 125,112,195,174,125,42,49,125,62,10,    1019
440 DATA 24,238,42,49,125,62,11,24,231,4,        810
450 DATA 254,73,40,24,4,254,72,40,26,195,        982
460 DATA 190,125,42,92,125,62,1,119,35,175,      966
470 DATA 119,42,94,125,112,195,217,125,42,92,    1163
480 DATA 125,62,10,24,238,42,92,125,62,11,       791
490 DATA 24,231,0,0,0,0,0,0,0,0,                 255
500 REM
          ...........END OF DATA..............
600 REM ** Start of DEMO Adventure **
609 REM ** You MUST define GET varibles eg. V and N **
610 CLS:CLEAR 500:DEFINT V,N
619 REM ** Disable BREAK key **
620 POKE 16396,7
624 REM ** Verb table at 32384.Noun table follows **
625 VB=32384:NO=VB+25:E$=STRING$(3,255)
629 REM ** Make VERB table in VB$. (Max 240 chars) **
630 VB$="SAVEXATHR"+E$: REM SAVe,EXAmine,THRow
639 REM ** Do the same for NOUN table **
640 NO$="HILFIECOR"+E$: REM HIL1,FIEld,CORn
650 A=VB:PO$=VB$:GOSUB660:A=NO:PO$=NO$:GOSUB660:GOTO680
660 FORI=1TOLEN(PO$):POKE A,ASC(MID$(PO$,I,1)):A=A+1
670 NEXT:RETURN
679 REM ** Tell A/D were the word tables are **
680 POKE 32120,VB AND255:POKE 32121,VB/256
690 POKE 32134,NO AND255:POKE 32135,NO/256

699 REM ** Get command from player **
700 PRINT"You are in a large field filled with corn.
Objects : A SCARE-CROW":PRINT"
-------> What now ? ";:GET V,N:PRINTSTRING$(63,45)
710 IF V=0 THENPRINT"
Sorry don't understand the verb":GOTO700
720 IF N=0 THENPRINT"
Sorry don't understand the noun":GOTO700
729 REM ** Jump to decoding routines **
730 ON V GOTO 800,850,900
800 REM ** Save Game **
810 '...CODE FOR SAVING GAME...
849 GOTO700
850 REM ** Examine **
860 '...CODE FOR EXAMINE...
895 PRINT"Nothing interesting"
899 GOTO700
900 REM ** THROW **
910 '...CODE FOR THROW...
949 GOTO700
   and so on....
```

MTX Old

by P Walker

I am assured by MTX500 and 512 programmers that one of the major dangers of programming an MTX is accidental erasure of a program. There are three software resets (PRINT USR (O),RST O and NEW), as well as hardware resets and misplaced POKEs all resulting in a lost program and re-initialised system variables. This utility provides a much needed OLD command to restore lost programs from one of the above-mentioned causes.

The program should be loaded and run before programming begins. The program places itself at the top of RAM, lowers RAMTOP and deletes its own listing, and is therefore transparent both to user and system. You can now type or load in a program. When you are ready to start debugging type (PRINT(USR(49010). If, for any reason, the program is cleared from memory, typing (PRINT(USR(49069)) while debugging will restore it.

To run on an MTX500 two minor changes are necessary:

(1) Change LD HL, 4069 to LD HL, 8069 in line 0.

(2) Change the two occurrences of LD IX, 4000 to LD IX, 8000 in line 2.

```
"OLD" FACILITY FOR THE MTX 512/500

0 CODE
     LD HL,#4069     ;START ADDRESS OF "OLD"
     LD DE,#BF72     ;ADDRESS "OLD" MOVED TO
     LD BC,#0076     ;LENGTH OF "OLD"
     LDIR            ;MOVE "OLD" TO #BF72
     LD A,#F6        ;OFF SET FOR (DJNZ) JUMPS USED IN "OLD"
     LD (#BFA8),A    ;POSITION OF (DJNZ)
     LD (#BFE4),A    ;POSITION OF 2nd (DJNZ) IN "OLD"
     RET

1 NEW
2 CODE
     LD IX,#4000     ;START ADDRESS OF PROGRAM TO BE RELOADED---1st SECTION OF "OLD"---
     LD HL,#BFE9     ;START ADDRESS FOR PROGRAM DATA TO BE SAVED
     LD B,#08        ;COUNTER FOR PROGRAM DATA
     CALL #BF9F      ;CALL SAVE ROUTINE
     LD IX,#FAA4     ;START ADDRESS OF VARIABLES TO BE SAVED
     LD B,#0A        ;COUNTER FOR VARIABLE DATA
     CALL #BF9F
     LD A,(#FACC)    ;TOP OF ARRAYS (LOW BYTE)
     CALL #BFAA      ;CALL SAVE ROUTINE
     LD A,(#FACD)    ;TOP OF ARRAYS (HIGH BYTE)
     CALL #BFAA
     LD A,(#FAD6)    ;TOP OF PAGE (LOW BYTE)
     CALL #BFAA
     LD A,(#FAD7)    ;TOP OF PAGE (HIGH BYTE)
     JP #BFAA        ;JUMP TO SAVE ROUTINE AND RETURN TO BASIC
     LD A,(IX+0)     ;SAVE ROUTINE AT #BF9F---LOAD A,DATA BYTE
     CALL #BFAA      ;CALL SAVE ROUTINE
     INC IX          ;MOVE POINTER TO NEXT DATA BYTE
     DJNZ #BF9F      ;CHECK DATA COUNTER/ IF NON ZERO REPEAT ROUTINE
     RET             ;RETURN FROM ROUTINE
     LD (HL),A       ;SAVE ROUTINE AT #BFAA---SAVE DATA BYTE TO HL LOCATION
     INC HL          ;SET POINTER TO NEXT SAVE ADDRESS
     RET             ;RETURN FROM ROUTINE
     LD IX,#4000     ;ADDRESS TO RELOAD PROGRAM---2nd SECTION OF "OLD"---
     LD HL,#BFE9     ;START ADDRESS OF PROGRAM DATA
     LD B,#08        ;COUNTER FOR PROGRAM DATA
     CALL #BFDB      ;CALL RELOAD ROUTINE
     LD IX,#FAA4     ;ADDRESS OF VARIABLES TO BE RELOADED
     LD B,#0A        ;COUNTER FOR VARIABLE DATA
     CALL #BFDB
     CALL #BFE6      ;CALL LOAD ROUTINE
     LD (#FACC),A    ;RELOAD TOP OF ARRAYS (LOW BYTE)
     CALL #BFE6
     LD (#FACD),A    ;TOP OF ARRAYS (HIGH BYTE)
     CALL #BFE6
     LD (#FAD6),A    ;TOP OF PAGE (LOW BYTE)
     CALL #BFE6
     LD (#FAD7),A    ;TOP OF PAGE (HIGH BYTE)
     RET             ;RETURN TO BASIC
     CALL #BFE6      ;RELOAD ROUTINE AT #BFDB
     LD (IX+0),A     ;RELOAD DATA BYTE INTO PROGRAM/VARIABLE SECTION OF MEMORY
     INC IX          ;MOVE POINTER TO NEXT MEMORY POSITION
     DJNZ #BFDB      ;CHECK DATA COUNTER/IF NON ZERO REPEAT ROUTINE
     RET             ;RETURN FROM ROUTINE
     LD A,(HL)       ;RELOAD ROUTINE AT #BFE6---RETRIEVE DATA BYTE
     INC HL          ;MOVE POINTER TO NEXT DATA LOCATION
     RET             ;RETURN FROM ROUTINE

 3 REM  C. P WALKER  1984
```

Commodore 64 Screendump

by Matthew Burt

Screendump allows the printing of high resolution or user-defined character screens on the Commodore 801 printer. If a normal text screen is dumped, the standard '64 character set will be used instead of the 801 set. There are two stages:

(1) Load and run to locate the routine in memory anywhere above 800 hex. There is a default option to put the routine above the Basic text and protect it.

(2) Call the specified address either from Basic or a machine code monitor.

The 801 must be device four and contain paper that can accommodate 54 characters across.

Screendump leaves the printer in graphics mode, so ASCII character 15 must be sent before normal use.

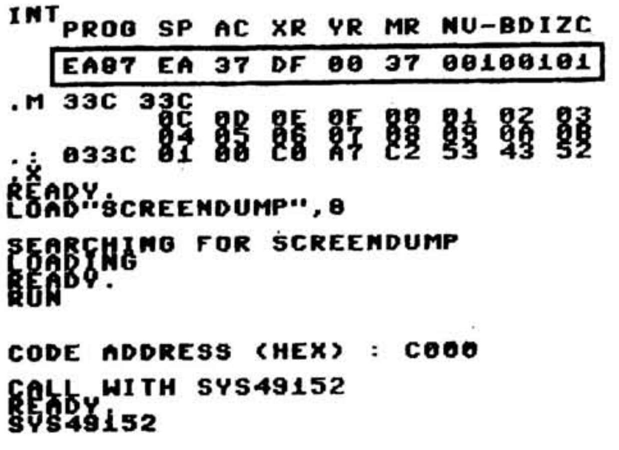
Any screen that uses sprite graphics will be printed but the graphics will be invisible. The result with screens that use raster interrupts are, at best, highly unpredictable.

Lines 1000-1800 contain the data of the machine code routine in decimal. Lines 2040-2100 actually transfer the DATA into memory using a dummy OPEN in line 2060. Pay particular attention when typing lines 2000-2100. Any error here will not be detected in the same way as the DATA lines.

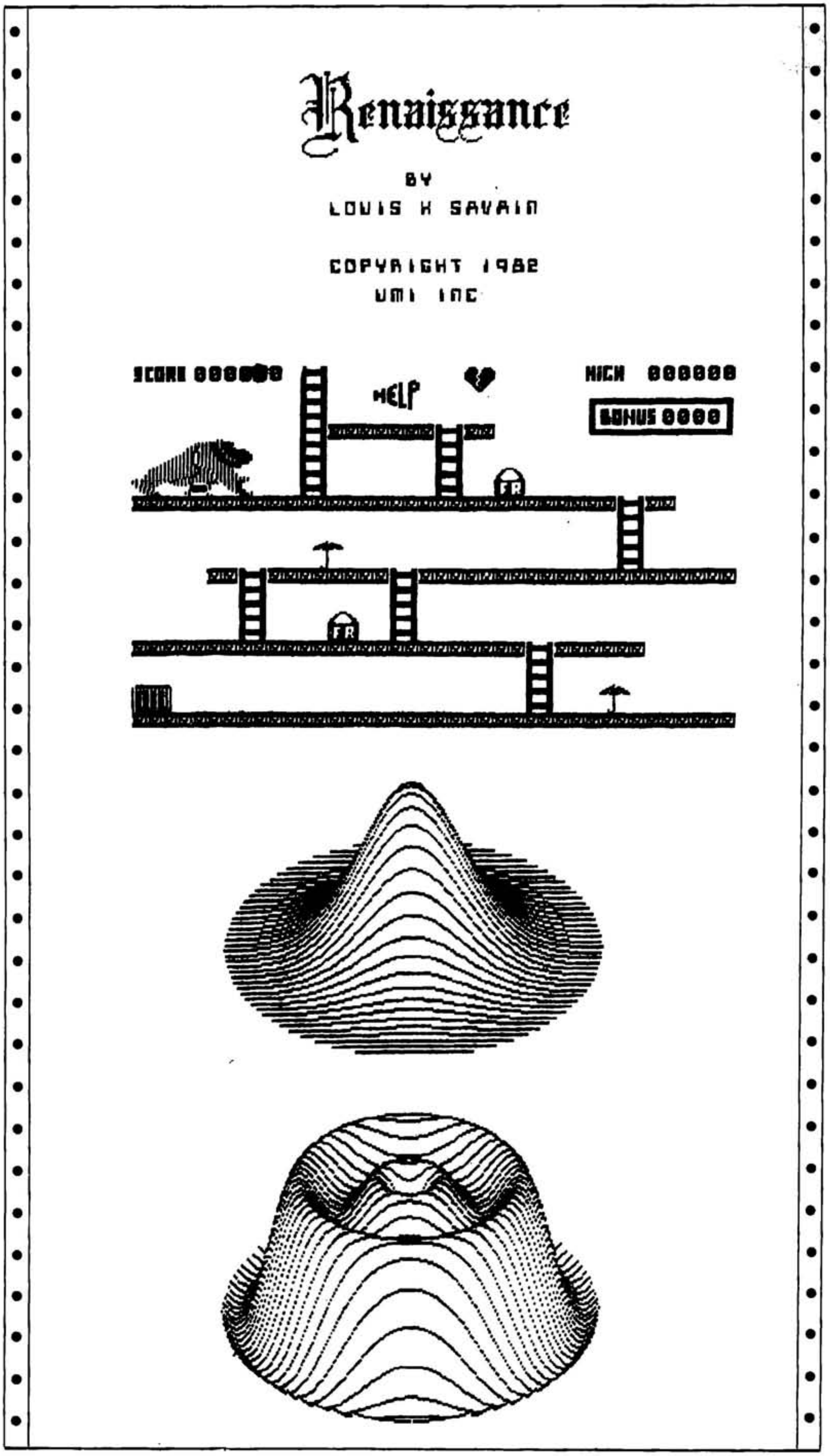
To prove the program works there are some example printouts of graphics dumps done with the utility. On running, the prompt
CODE ADDRESS (HEX) :
will be displayed. Type an address (such as C000 or C800 or 9000) or press RETURN for the top of memory option. If all is well, the message
CALL WITH SYS xxxx
will be displayed. Use this SYS to dump the screen to the 801. Monitor users may wish to locate the code under the Basic ROM.

```
1000 DATA11,8,10,0,158,50,53,50,340
1010 DATA51,0,0,0,169,4,170,160,554
1020 DATA0,32,186,255,169,0,32,189,863
1030 DATA255,32,192,255,162,4,32,201,1133
1040 DATA255,169,8,32,210,255,169,3,1101
1050 DATA56,237,0,221,10,10,10,10,554
1060 DATA10,10,133,35,173,17,208,41,627
1070 DATA32,141,94,1,240,14,169,8,699
1080 DATA45,24,208,10,10,101,35,141,574
1090 DATA92,1,144,23,174,24,208,138,804
1100 DATA41,14,10,10,101,35,141,93,445
1110 DATA1,138,41,240,74,74,101,35,704
1120 DATA141,92,1,169,0,141,95,1,640
1130 DATA169,0,141,96,1,141,97,1,646
1140 DATA169,128,133,36,169,1,133,37,806

1150 DATA32,183,0,144,6,165,37,5,572
1160 DATA36,133,36,6,37,238,95,1,582
1170 DATA165,37,16,236,165,36,32,210,897
1180 DATA255,173,95,1,170,56,233,7,990
1190 DATA141,95,1,238,96,1,208,3,783
1200 DATA238,97,1,173,97,1,240,200,1047
1210 DATA173,96,1,201,64,144,193,169,1041
1220 DATA13,32,210,255,142,95,1,224,972
1230 DATA203,144,173,32,204,255,169,4,1184
1240 DATA76,195,255,173,95,1,201,200,1196
1250 DATA144,2,24,96,41,248,133,34,722

1260 DATA160,0,132,35,10,38,35,10,420
1270 DATA38,35,101,34,144,2,230,35,619
1280 DATA10,38,35,10,38,35,10,38,214
1290 DATA35,133,34,173,96,1,41,248,761
1300 DATA101,34,133,34,173,97,1,101,674
1310 DATA35,133,35,172,94,1,240,7,717
1320 DATA109,92,1,133,35,144,39,74,627
1330 DATA102,34,74,102,34,74,102,34,556
1340 DATA109,92,1,133,35,32,54,1,457

1350 DATA160,0,132,35,10,38,35,10,420
1360 DATA38,35,10,38,35,133,34,165,488
1370 DATA35,109,93,1,133,35,173,95,674
1380 DATA1,41,7,168,173,96,1,41,528
1390 DATA7,170,32,54,1,10,202,16,492
1400 DATA252,96,120,165,1,72,165,35,906
1410 DATA41,127,201,16,144,11,201,32,773
1420 DATA176,7,105,192,133,35,169,251,1068
1430 DATA44,169,252,37,1,133,1,177,814
1440 DATA34,168,104,133,1,88,152,96,776
1450 DATA13,13,67,79,68,69,32,65,406

1460 DATA68,68,82,69,83,83,32,40,525
1470 DATA72,69,88,41,32,58,32,0,392
1480 DATA13,13,67,65,76,76,32,87,429
1490 DATA73,84,72,32,83,89,83,0,516
1500 DATA13,13,84,79,79,32,76,79,455
1510 DATA87,0,32,210,255,232,189,105,1110
1520 DATA9,208,247,96,90,45,25,62,782
1530 DATA61,255,124,75,100,4,20,113,752
1540 DATA164,167,248,110,159,172,239,56,1315

1550 DATA105,137,149,156,184,199,50,7,987
1560 DATA8,8,8,7,7,7,7,7,59
1570 DATA8,8,7,7,7,7,7,7,58
1580 DATA7,7,8,7,7,7,7,7,57
1590 DATA7,8,162,0,32,159,9,32,409
1600 DATA207,255,201,13,208,23,165,55,1127
```

```
1610 DATA233,98,133,55,133,34,165,56,907
1620 DATA233,1,133,56,133,35,208,55,854
1630 DATA169,63,76,210,255,162,0,134,1069


1640 DATA34,134,35,56,233,48,144,240,924
1650 DATA201,10,144,10,233,7,201,10,816
1660 DATA144,230,201,16,176,226,10,10,1013
1670 DATA10,10,162,4,10,38,34,38,306

1680 DATA35,176,213,202,208,246,32,207,1319
1690 DATA255,201,13,208,214,165,35,201,1292
1700 DATA11,176,5,162,40,76,159,9,638
1710 DATA162,26,189,165,9,133,36,189,909
1720 DATA192,9,133,37,24,160,254,177,986
1730 DATA36,121,36,255,145,36,200,208,1037
1740 DATA246,202,16,230,169,13,162,8,1046

1750 DATA133,36,134,37,160,0,177,36,713
1760 DATA145,34,200,208,4,230,35,230,1086
1770 DATA37,192,92,208,241,165,37,201,1173
1780 DATA9,208,235,162,24,32,159,9,838
1790 DATA166,35,202,138,166,34,32,205,978
1800 DATA189,32,68,166,108,2,160,0,725

2000 FORK=49152TO49792STEP8
2010 A=0:FORI=KTOK+7:READJ:POKEI,J:A=A+J:NEXT
2020 READJ:IFA<>JTHENPRINT"DATA ERROR IN LINE
     "(K-49152)/4*5+1000:STOP


2030 NEXT
2040 INPUT"SAVE TO DEVICE NO.";D
2050 IFD<1ORD=2ORD=3THEN2040
2060 OPEN1,3,0,"SCREENDUMP":POKE781,


2070 POKE251,0:POKE252,192
2080 POKE780,251:POKE781,167:POKE782,194:SYS65496
2090 IFPEEK(783)AND1THENPRINT
"SAVE UNSUCCESSFUL - TRY AGAIN"
2100 CLOSE1:END
```



```
INT
   PROG SP AC XR YR MR NU-BDIZC
   EA87 EA 37 DF 00 37 00100101
.M 33C 33C
        0C 0D 0E 0F 00 01 02 03
        04 05 06 07 08 09 0A 0B
.: 033C 01 00 C0 A7 C2 53 43 52
.X
READY.
LOAD"SCREENDUMP",8

SEARCHING FOR SCREENDUMP
LOADING
READY.
RUN

CODE ADDRESS (HEX) : C000

CALL WITH SYS49152
READY.
SYS49152
```



Renaissance

BY
LOUIS H SAVAIN

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NEWCOMERS START HERE

This is our unique quick-reference guide, reprinted every month, to help our readers pick their way through the most important pieces of (necessary) jargon found in APC. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

Probably the first thing you noticed on picking up this magazine for the first time was the enormous amount of unintelligible-looking jargon. In the words of *The Hitch-hiker's Guide to the Galaxy:* Don't panic! Baffling as it may sound, the jargon does actually serve a useful purpose. It's a lot easier to say VDU, for example, than 'the screen on which the computer's output is displayed.' This guide is intended to help you find your way around some of the more common 'buzzwords' you're likely to come across in the pages of *APC.*

For those completely new to computing, let's start with the question: What is a microcomputer? We can think of a micro as: a general-purpose device in contrast to a typewriter, which can only be used for typing; a calculator, for performing calculations; a filing cabinet, for filing information, to name just a few of its functions. A micro can do all these things and more.

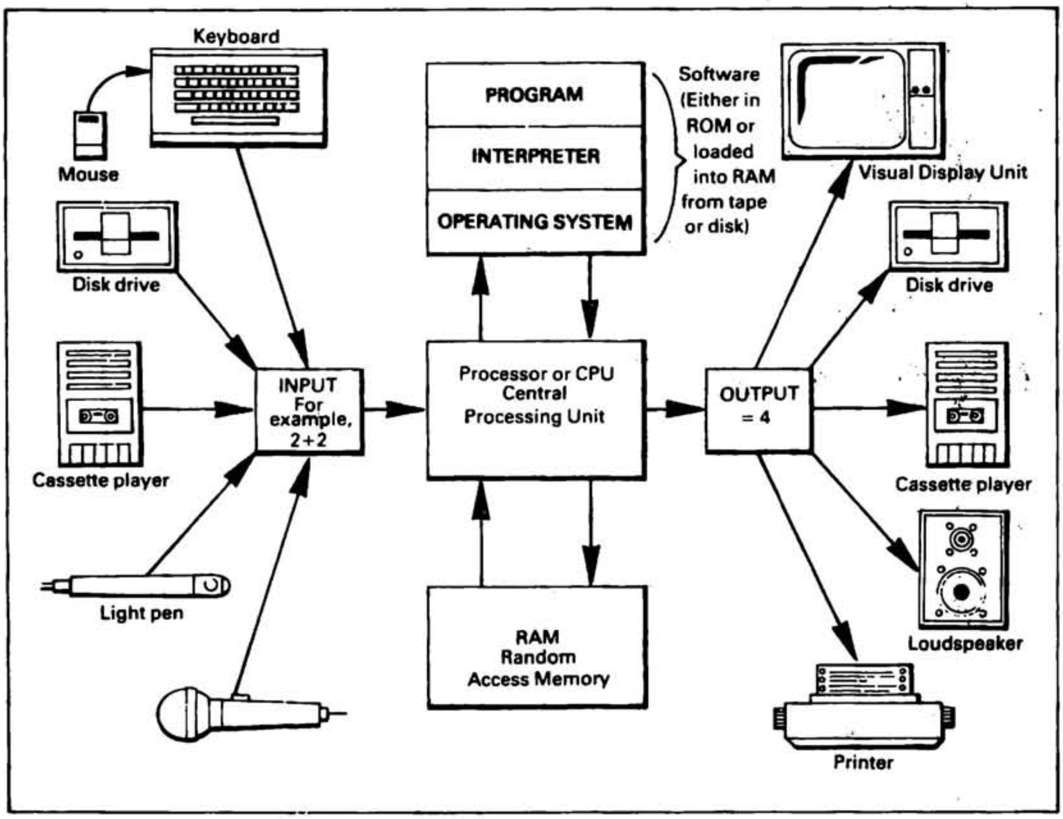
If it's to be of any use, a general-purpose device needs some way of knowing what to do. We do this by giving the computer a set of logical instructions called a *program.* The general term for computer programs is *software.* Every other part of a microcomputer system is known as *hardware:* 'If you can touch it, it's hardware.'

Programming

Programs must be written in a form the micro can recognise and act on — this is achieved by writing the instructions in a *code* known as a *computer language.* There are literally hundreds of different languages around, the most popular of these being *Basic.* Basic is an acronym of Beginners' All-purpose Symbolic Instruction Code. Although originally intended as a simple introductory language, Basic is now a powerful and widely used language in its own right.

Other languages you're likely to come across in *APC* are *Forth, Pascal, Logo, C* and *Comal* to name but a few. These are known as *high level* languages because they approach the sophistication of a human language. You'll also see references in *APC* to the *low level* languages, *assembly language* and *machine code.* We'll look at these in a moment.

The heart of a micro, the workhorse, is the *processor* or Central Processing Unit *(CPU).* The processor usually consists of a single silicon chip. As with computer languages, there are a number of different types of processor available, *Z80, 6502, 6800* and *8088* being just a handful (literally) of the types in common use. The processor is nothing magical — it's just a bunch of electronic circuits. It's definitely not a 'brain'.



A schematic view of a microcomputer system

As it's electronic, the processor's circuitry can be in one of two states: on or off. We represent these two states by *binary* (base two) notation, the two binary digits (known as *'bits'*) being 0 and 1. It's possible to program computers in binary notation, otherwise known as machine code (or machine language) programming.

Machine code is called a low level language because it operates at a level close to that understood' by the processor. Languages like Basic are known as high level languages because they are symbolic, operating at a level easily understood by people but not directly understood by the processor.

Between high level languages and machine code is a low level language known as assembly language or, colloquially, *assembler*. This is a mnemonic code using symbols which the processor can quickly convert to machine code.

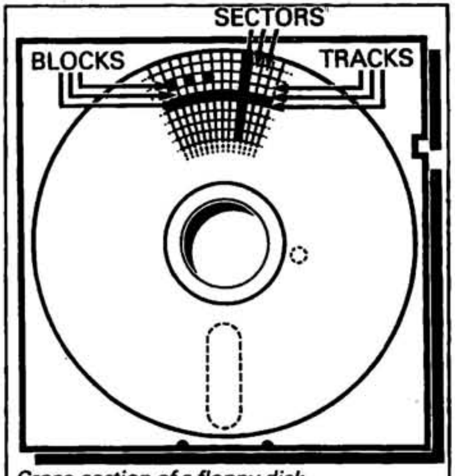
Since everything has to be converted into binary form before the processor can make sense of it, we need some sort of code to represent each character to be processed by the computer. In order to simplify communication between computers, a number of standard codes have been agreed on. The most widely used of these codes is the American Standard Code for Information Interchange, *ASCII*. This system assigns each character a decimal number which the processor can then convert to its binary equivalent.

A program written in a high level language must be converted into binary before the processor can carry out its instructions. We could of course do this manually, but since this is exactly the sort of tedious job computers were designed to do for us, it makes much more sense to write a program to do it.

There are two types of program to do this translation for us.

The first of these is a *compiler* which translates our whole program permanently into machine code. When we *compile* a program, the original high level language version is called the *source code* while the compiled copy is called the *object code*. Compiled programs are fast to run but hard to edit. If we want to change a compiled program, we either have to edit it in machine code (extremely difficult) or we have to go back to a copy of the source code. For this reason there is a second translation program: an *interpreter*. An interpreter waits until we actually *run* (use) the program, then translates one line at a time into machine code — leaving the program in its original high level language. This makes it slower to run than a compiled program, but easier to edit.

There are two unusual Basic words you're likely to come across: *POKE* and *PEEK*. When you program in a high level language, you are normally unable to choose in which part of the machine's memory the processor will store things. This makes programming easier as you don't need to worry about memory locations, but slows down the program since the processor has to 'look up' addresses for you. Using the POKE command, however, you can 'poke' a value directly into a desired memory address. 'POKE 10000,56', for example, puts the value 56 into memory location 10000. PEEK allows you to examine the content of a particular memory address. If you were to follow the above poke with 'PEEK (10000)', the computer would respond by displaying the value 56. POKEing and PEEKing is normally done to increase program speed, but may also allow us to do things which could not be done through Basic.



Cross-section of a floppy disk

Memory

So far, we have a processor and a program. Since a computer needs somewhere to store programs and data, it needs some kind of *memory*. There are two types of memory: *Read Only Memory (ROM)* and the badly named *Random Access Memory (RAM)*. ROM is so-called because the processor can 'read' (get things out of) its contents, but is unable to 'write to' (put things in) it.

ROM is used to store *firmware*, the name given to software permanently available on the machine. An interpreter is a typical example of firmware (stick with it: it gets easier!).

RAM differs from ROM in two important ways. Firstly, you can write to it as well as read from it. This means that the processor can use it to store both the program it is running and *data* (information). The second important difference is that RAM needs a constant power supply to retain its contents: as soon as you switch the computer off, you lose your program and data.

There is a type of RAM, known as *CMOS RAM*, which requires only a tiny amount of power to retain its contents. This is found in portable computers like the Tandy 100. It is usually powered by small ni-cad batteries so that programs and data are retained even when the main power is switched off. At present, CMOS RAM is extremely expensive and is not likely to be used in desktop machines for a little while yet. (CMOS stands for Complementary Metal Oxide Semiconductor).

Memory is described in terms of the number of characters we can store in it. Each character is represented by an 8 bit binary number. 8 bits make one *byte* and 1024 bytes make one *Kilobyte* or *1k*. 32k, for example, means that the computer can store about 32000 characters in its memory. If 1024 sounds like an odd number, remember that everything is based on the binary system, thus 1,2,4,8,16 . . . 1024 being the nearest binary multiple to 1000.

While we're on the subject of bits, you'll often see computers and their processors described in terms of their *bit power: 8-bit, 16-bit, 32: 16-bit* and so on. This is a means of describing how large a binary number the processor can handle in one chunk. A binary number, incidentally, is known — confusingly — as a *word*. An 8-bit processor, for example, can handle 8-bit words, that is, up to 11111111 (255 in decimal). Anything larger than this has to be broken down into manageable chunks before it can be processed.

A 16-bit machine can handle bigger chunks of data at a time. This means it can handle (*'address'*) larger amounts of memory at one time. This is why most 8-bit machines have a maximum of 64k RAM while 16-bit micros usually have 128k upwards.

As 16-bit processors can handle larger words than an 8-bit machine, they ought to be twice as fast. In practice, however, there is a little more to it than that. While it may take a 16-bit machine half as long to work out that 2+2=4, the actual processing is only part of the story.

The result of the calculation has to be placed into the appropriate memory location, passed to the screen or whatever is required. The transfers to and from the processor are often made in 8-bit form; this is why you'll hear people arguing that certain processors are not 'true' 16-bit. If the problem has to be handed to the processor in 8-bit form, turned into 16-bit, calculated and then the result turned back into 8-bit for transfer elsewhere, there may be little or no saving in time over an 8-bit system.

The other factor affecting speed is that the actual processing may form only a small part of the overall operation. A word processor, for example, spends most of its time passing files to and from disk and waiting for the user to type the next character. The processing itself consumes very little time. And if you look at the Benchmarks summary (*APC*, February 1984, pp 59-60), you'll see some 8-bit machines beating their 16-bit rivals — even in processor-bound operations like the *APC* Benchmarks.

Returning to the subject of RAM for a moment, a word of warning: Don't rush out with your new-found understanding to buy the machine offering you the most RAM for your money. Quite aside from the fact that the amount of RAM is by no means the only consideration when buying a micro (no matter how much manufacturers may stress it), different machines use differing amounts of RAM for things like graphics. Always check how much RAM is actually available to the user for program storage. Machines which proudly proclaim '64k' may well leave you with less than half of this in which to store Basic programs and data.

Back-up storage

There are numerous forms of *permament* or *back up storage*, but by far the most common are *floppy disk, floppy tape* and *cassette*.

Floppy disks or diskettes are circular pieces of thin plastic coated with a magnetic recording surface similar to that of tapes. The disk, which is enclosed in a protective card cover, is placed in a *disk drive*. Disk drives comprise a high-speed motor to rotate the disk and a

NEWCOMERS START HERE

read/write head to record and 'play back' programs and data.

The disk is divided into concentric rings called *tracks* (similar to the tracks on an LP) which are in turn divided into small *blocks* by spoke-like divisions called *sectors*.

There are two methods for dividing the disk into sectors. One method is called *hard sectoring*, where holes punched in the disk mark the sectors, and the other is *soft sectoring* where the sectors are marked magnetically. The reason that disks from one machine can't be read by a different make is that each manufacturer has its own way of dividing up the disk. Recently, however, manufacturers have apparently begun to acknowledge that this situation can't go on forever, and they are working on making their disks compatible.

Since the computer needs some way of organising the disk, we have a program called a *Disk Operating System (DOS)*, usually known simply as the *Operating System (OS)*. The operating system does all the 'housekeeping' of the disks, working out where to put things, letting the user know what is on the disk, copying from one disk to another and so on. As you might expect by now, there are lots of different operating systems available, each with its own advantages and disadvantages. The three most popular OSs are *CP/M* (Control Program for Micros), *MS-DOS* (MicroSoft Disk Operating System) and *PC-DOS* (Personal Computer Disk Operating System). MS-DOS and PC-DOS, incidentally, are all but identical.

Disks can support what are known as *random access files*. That is, you can randomly choose a point in a file and the drive head will move directly to that point. You can then edit the file, and only the blocks affected will be rewritten. The rest of the file remains unchanged.

Floppy disks provide a reasonably fast and efficient form of secondary storage and are cost-effective for business machines. For home computers, however, the usual form of program and data storage is on ordinary cassette tape using a standard cassette recorder. This method of storage is slow and unreliable, but is very cheap and adequate for games, for example.

Cassettes can support only *serial access files*. That is, whenever a file is to be edited, the whole file must be written back to the tape. This makes certain applications — word processing being a prime example —extremely tedious.

Floppy tape drives are a compromise between speed and cost. They use a small continuous loop tape which, like a disk, is divided into blocks. Floppy tape drives rely on serial access files, but by rotating the tape at high speed and using the block markers, they can simulate random access files.

Another type of disk you'll see referred to is the *hard disk*. This is an extremely efficient method of storing large amounts of data. Hard disk capacity generally starts at around 10 *Mbytes* (10 million bytes) and rises to . . . well, you name it. Besides offering a much greater capacity than floppies, hard disks are more reliable and considerably faster. They are, however, much more expensive than floppy drives.

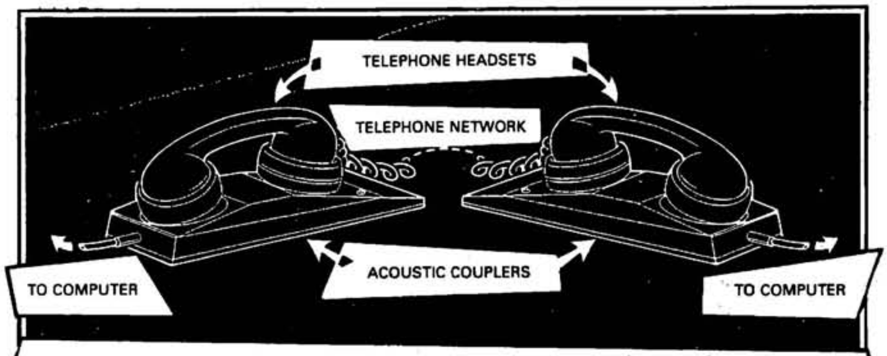
Input/output

Since computers need some way of communicating with the outside world, we need *input* and *output* devices. Input and output devices include all manner of things from hard disk units to light pens, but the minimum requirement for most applications is a typewriter-style *keyboard* for input and a TV-like *Visual Display Unit* for output. The Visual Display Unit is variously referred to as a *VDU, Cathode Ray Tube (CRT)* and monitor.

The various component parts of a computer system (processor, keyboard, VDU, disk drives, and so on, may all be built into a single unit or they may be separate, connected by cables.

Take this paragraph slowly and it will make sense! When a computer communicates with an outside device, be it a printer or another computer, it does so in one of two forms — *parallel* or *serial*. Parallel *input/output (I/O)* requires a number of parallel wires. Each wire carries one bit, so with eight wires we can transmit/receive information one byte at a time (8 bits = one byte, remember). Serial I/O, in contrast, uses a single wire to transmit a series of bits one at a time (that's why it's called serial), with extra bits to mark the beginning and end of each byte.

To enable different devices to communicate with each other in this way, standards have been agreed for different *interfaces*. An interface is simply a piece of circuitry used to connect two or more devices. The most common standard serial interface is the *RS232* (or *V24*) while the Centronics standard is popular for parallel interfaces.



Computer-to-computer communications using acoustic couplers.

Networks

When two computers want to communicate with each other over a distance, there are again two ways of doing it (nothing is ever clear-cut in the world of micros — you'll get used to it). Both methods use the public phone network. The first is known as an *acoustic coupler*. This simply plugs into your computer, and has a receptacle into which you place your telephone handset. The acoustic coupler is convenient in that you can unplug it from one computer and plug it into another one in a matter of seconds. They are generally slow, however, and prone to interference.

The alternative method is to use a *modem*. Unlike an acoustic coupler, a modem is wired into the telephone system and you should get permission for this from Telecom.

A term you'll hear used in connection with acoustic couplers and modems is *baud rate*. The baud rate is a measure of the speed at which a device can transmit and receive data. You can safely think of the baud rate as being bits-per-second, though the accurate definition is a little more complex. Therefore, a 300-baud modem can transmit/receive data at the rate of 300 bits (about 50 characters) per second.

A 1200/75 modem means that it receives at 1200 baud but transmits at 75. Most modems are 1200/75 and acoustic couplers 300/300. By way of comparison, saving programs to cassette is normally done at between 300 and 1500 baud.

Finally, communications between computers is either *full* or *half duplex*. Full duplex is when the machine receiving the data echoes it back to the machine transmitting it and says 'This is what I think you said — is that right?'. If it's wrong, the section will be transmitted again. Half duplex is where no checking is made. If you're ever unsure of which to use, start with full duplex. If everything you type appears on your display twice, then you should switch to half duplex.

Database

A database allows you to store, process and report on structured information. Most of the cheaper packages are based on a traditional card index where each card about an individual, order or item of stock is stored in a single record and a group of like records is stored in a file (corresponding to the index card box). Sophisticated packages can relate several files together, so that you can process groups of dissimilar but related records.

Spreadsheet

Spreadsheet software is useful to anyone who regularly uses a calculator. The VDU acts like a 'window' on a large sheet of numbers — neatly laid out in rows and columns, occasionally interspersed with text headings. The user is able to shift the window to the point of interest and so enter text. The rest of the calculation is displayed immediately with automatic recalculations throughout.

BACK ISSUES

This Back Issues listing has been updated to include all of the available 1984 issues of APC. An order form is included at the end of the listing. Please allow up to four weeks for delivery.

Volumel No 6, 1980
Benchtests: Commodore 8032. SuperBrain/Overview of chess machines and micro programs/Writing machine independent Basic programs/Printer review/Programs: Lunar Lander (TRS-80), PET Fighter Pilot, Apple Plotting, LPrint to Print utility (TRS-80), ZX80 Breakout, Graph (TRS-80).

Volume 2 No 3. 1981
Checkout: Sinclair ZX81/APC-80: Recovering lost programs, JUMP command (allows a GOTO "numeric expression")/Building a Bigboard/Keystroke reduction for EDTASM users/Sanders Printer reviewed/Profile of BS Microcomp/CP/M explained by Rodnay Zaks/The rapid bubble sort for the Apple/Encryption for any Microsoft Basic/An imagined 6502 "Dream Machine" specs/Vectors explained on the Challenger IP/Programs: TRS-80 flashing cursor and non-destructive backspace, Treasure Hunt (PET).

Volume 2 No 4, 1981
Benchtest: VIC-20, Tandy TRS-80 III/TRS-80 Monitor software compared/Computer Games: Backgammon on micros/Tree access routines explained/Gateways to Logic, Part 8: Peripherals/How Computers Communicate, Part 1: What is I/O?/Profile Gary Blom of the Computer Company/Part 1 of 2: Defining program specification needs/6502 Assembler in Basic/Wordpower wordprocessor program for the PET/Programs: PET Arithmetic Test, Apple Mondrian.

Volume 3 No1, 1982
Benchtest: Tandy TRS-80 Color/Checkouts: Hitachi Peach, Sharp's Microtranslator, BBC Proton/Profile of Rodnay Zaks/Sorting alphanumeric codes from disk to disk/Computer games:GO-MOKU on micros/Generating Patterns with a computer, Part 3: The parallel interface/Review of Forth Language/A neat way to describe programs quickly and logically/Speech Synthesis for the TRS-80s, System 80s, Part 1/Cassette utility for System 80 on Eprom/An easy route to shape tables for the Apple/Rubik Cube Simulation for the Apple/How to implement "Turtle" graphics on an Apple/Programs: Get Simulation (Apple), Bug Bug (TRS-80), Cryptography (Microsoft Basic).

Volume 3 No 2, 1982
Checkout: Apple III/Fitting a smooth curve to complex data plots/Speech synthesis for TRS-80s, System 80s, Part 2/"Bridge" on micros/Relocating assembly language programs/Binary sort explained/Programmable rhythm generator project for PET/Large number calculations on micros/Basic interpreters explained/Checkout: ZX81 printer/APC-80 overview and debounce routine/Storing arrays on tape/Frames of Reference, Part 1: A DP manager's guide to micros/How Computers Communicate, Part 4: The IEEE interface/Overview of micro-computer databases/Programs: TRS-80 Alien Seabattle.

Volume 3 No 3, 1982
Benchtest: Hewlett Packard HP-125/WP Benchtest: Scripsit 2.0/Checkout: Dick Smith Votrax Type 'N Talk, The Australian Beginning/Videotext overview/Frames of Reference, Part 2: Hardware and Software Suppliers/Profile: Jim Warren of the West Coast Computer Faire/How Computers Communicate Part 5: The BCD Interface/Installing hi-res on the TRS-80/Bridge playing program reviewed/Programs: Galacti-Cube (3D Maze in fairly "standard" Basic), PET Fantasy, ZX80 Labyrinth, PET Juggle.

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Volume 3 No 4, 1982
Benchtests: Osborne 01, Micro Bee/APC-80: Command mode syntax error recovery/How Computers Communicate Part 6: The RS232 interface/80 x 24 display controller project/Preview of the Commodore 64/Atari 400 games reviewed/Profile: Adam Osborne/ANS Basic's features/Solving the hidden surface problem in 3D graphics/Frames of Reference, Part 3: Micros in mainframe company/Hewlett Packard's networking capability/Programs: TRS-80 Reaction Timing, ZX81 Graphplot, PET Cheese, Superboard Spin-Fighter, TRS-80 Extra.

Volume 3 No 5, 1982
Benchtests: Texas Instruments TI 99/4A, Xerox 820/Database Benchtest: FMS-80/TRS-80 Model 1 games reviewed/Frames of Reference, Part 4: Software standards/How Computers Communicate, Part 7: Interrupts in micro systems/How to use 3D graphics/Equation solving program/80 x 24 display controller project, Part 2/"Logo" Overview/Printer survey/Casio's calculator printer/Programs: TRS-80 Double Precision Maths and Trig, Apple 3D Maze,Atari Sums for Kids, Apple Air Flight.

Volume 3 No 6, 1982
Benchtests: Sinclair ZX Spectrum, Sirius I/Database Benchtest: dBase II/7th West Coast (micro-computer Faire)/Checkout: F-10 Daisywheel printer, Arfon Expandaboard/How Computers Communicate, Part 8: Direct memory access/Frames of Reference, Part 5: Buying micro hardware in a DP department/Self learning program/80 x 24 display controller project, Part 3 (end)/How to get more on Apple disks/Lisp — an artificial intelligence language/VIC-20 games reviewed/Implementing CP/M system calls from Microsoft Basic/APC Subset (first on new monthly column for assembler language routines)/Programs: TRS-80 Invader, PET Mini-animate, VIC-20 Trailblazer, ZX81 Book Index, Weebug Monitor (TRS-80), VIC-20 Large Characters.

Volume 3 No 7, 1982
Benchtests: Sharp MZ80B, Monroe OC 8820/Checkout: Sharp PC1500, The Micro-Professor/Apple II games reviewed/APC-80: Various PEEKs and POKEs explained/Reversing images on computer screens/Frames of Reference, Part 6: Putting your micro to work/How Computers Communicate, Part 9: Character codes/Educational arcade-type game/Programs: ZX81 Hypocycloids, TRS-80 Truth, PET Doc, TRS-80 Screen Dump, PET Boxes, Atari Earth.

Volume 3, No 9, 1982
Benchtest: ICL Personal Computer/Checkout: E40(CP/M data compression utility) Daisywriter printer, HP 11C & 120 calculators/BBC micro graphics capability/Best of APC's cartoons/How to use Benchmarks/Logo Program (Microsoft Basic) Computer generated textures/RS232 overview, Part 2/Memory-saving utility for Apple/How Computers Communicate, Part 11: Interrupts and buffers/Programs: Sytem 80 Extended Basic, Apple Trees, ZX81 Alphabetising, PET File Companion, PET German Game.

Volume 3 No 10, 1982
Benchtests: Hewlett Packard HP-86, National Panasonic JB3000/Checkout: Sharp PC-1211/UCSD p-System overview, Part 3 (end)/How to implement 3D graphics on a micro/CP/M-86 vs MS-DOS: Relative merits of these 16-bit operating systems discussed/Designing your own database/Monitor for TRS-80/System 80/File searching method/"Laws of Form" — a novel form of logic/How Computers Communicate, Part 12 (end)/Benchmarking high level languages/Programs: TRS-80 Cardshuffler, PET Knockout, PET Trains.

Volume 3 No 11, 1982
Benchtests: Hewlett Packard HP75C, Kaypro II, DEC Rainbow/Programs for the HP41C and Casio fx702p/Algebra checking program/More on MS-DOS vs CP/M-86/Predictions in the micro industry/Clock/calendar card for the Apple II, Part 1/Benchmarks summary/Programs: Apple II Piano Computer, Moon Module (Apple II, correction in Vol 4 No 1), Walls (Atari, correction in Vol 3 No 12).

Volume 4 No 2, 1983
Benchtests: Sharp PC1251/Database Benchtest: Hi Data/Micros as best friends/A major boost to the standards of 'user friendliness'/Computing can be a health hazard/'Expert Systems' — part two: appraisal of 'intelligent' computers/Networks: Part 1/The Logo Turtle checked-out/Getting the most from the BBC's graphics/Are home computers just a passing fad?/The Prestige vs The human: micro chess/Programs: Apple Character Plotter, System Tape Copier (TRS-80/System 80).

Volume 4 No. 6, 1983
Benchtest: Texas Instruments' Professional/Checkouts: Comx 35 home computer, NEC's Spinwriter daisywheel printer/Multi-Tool Word wordprocessor from Microsoft/Occam Occult: futuristic new language/The world of creative cross-figures/MicroBee games reviewed/Are micros a good idea?/Programs: Construction Worker (System 80, TRS-80), Chicken Little (MicroBee), PET Zombies, Spectrum Blaster, Commodore 64 Sprite editor.

Volume 4 No. 8, 1983
Benchtests: Apple Lisa, DOT/Checkouts: Osborne Executive, Epson FX-80 printer/Consumer Electronics Show Report/Will the Computer be the next dominant species on Earth/Milton Bradley's chess computer that moves its own pieces/Choosing suitable disks for your computer/Cryptography on a micro/Warnier Orr structured programming, Part 1/How to use the six function keys on the PC1500/Programs: ZX81 Least Squares, System 80 Loading tapes from an external cassette player, TRS-80/System 80 Adventure program, Apple II Pascal menu generation.

Volume 4 No. 9, 1983
Benchtests: Sord M5/Checkout: Tandy Model 100, Lisawrite/Screenplay: TI 99/4A games/

BACK ISSUES

Steve Wozniak returns to Apple/Choosing a home micro/Warnier Orr programming. Part 2/Graph plotting and curve fitting on the BBC Computer/Bemoaning the mechanical teller/Programs: VIC-20 Snake line. ZX81 Surround. Apple II Screenplay. PET Histogram.

Volume 4 No. 10. 1983

Benchtests: Archives PC/Home Computer Survey — 15 micros selling for less than $1000 checked out by Steve Withers in an exhaustive market survey/Checkout: Simons Basic. T/Maker III — office tool for the IBM PC. Digital Research Personal Basic/Computerising Your Business — a light and practical guide/Beginners Guide to Basic Program Conversion/Clever trick with TI Sprites/Cocktail program/Warnier Orr programming. Part III/How portable is portable/Programs: Atari No-Trons. TRS-80/System 80 Multi-Maths. Apple Text Maker. VIC 20 Spider.

Volume 4 No. 11. 1983

Benchtest: Apricot/Checkouts: Atari 600XL. Ashton Tate's Financial Planner. Condor database. Atari Writer/Which Spreadsheet? PerfectCalc/Profiles: Clive Sinclair. Nolan Bushnell/Set up your own computer learning centre/Basic Converter Chart/Warnier Orr Programming Part 4: Techniques (end)/Programs: PET Wave Simulation. Apple II Aplist. Microsoft Basic Calendars. TI99/4A Breakout. Commodore Testing Your Fingers. Apple Dotter Puzzle. VIC-20 Starship. Commodore Maths Test.

Volume 4 No. 12. 1983

Benchtest: TANDY MC-10/Checkout: Executive 816. Lotus 1-2-3. VisiOn. Gemini 15X Printer/Computerising Your Business: Part 2. Setting up/Sort Trees for beginners/Printing big on an Epson printer/Bulletin boards/Programs: VIC-20 Robotank. VZ-200 Missile Command. New 'Bee Screen. MicroBee Grooble Grab. Apple French Test Card. TRS-80 Road Rally.

Volume 5 No. 1. 1984

Benchtest: NEC PC-8201A/Checkouts: Coleco Adam. Kaypro 10. Atari Paint. Desq/Micro music — how it's done: Part 1/"Check Digits" — methods of ensuring correct data entry/Building models using surfaces. not lines/Column sort algorithm/Graphics on Tandy's Co Co/Spectrum listing: photofit/Locking Apple Listings/Programs: Commodore 64 Fast Sprites. IBM PC Sheepdog Trials. VIC 20 Variable List/Spectrum Lower CLS. Commodore 64 Monitor. Oric City Defense. MicroBee Tunes.

Volume 5 No. 2. 1984

Benchtest: Workslate. Commodore 720/Checkouts: Visuall. Sord's Falc. '64 Vizawrite. Brainstorm/DIY Apple Interface/TRS-80 Disassembler/Benchmark summary to-date/Basic Program Conversion. Part 2 (Part 1 in Vol.4 No. 11)/BBC Music. Part 1/Could speech synthesisers do long term damage to the language?/Programs: TRS-80 Pascal Procedures. PET Maths Maze. BBC Logic Tree. VIC 20 Grid Bike. '64 Heli-bomber. '64 Battlestar Fighter. Apple Bridge Builder.

Volume 5 No. 3. 1984

Benchtests: IBM PC Junior. Sharp MZ-700/Checkouts: Androbot's Topo. Homeword word processor. TK!Solver. Educational Games/Basic Program Conversion. Part 3: Apple II graphics/Atari memory (for patterns of colour and sound) tester/Teach Yourself Assembler. Part 1/BBC Music. Part 2/View of the future from the author of VisiCalc/Give your program cassettes a spoken index/Programs: Apple Stargo. PET Areas. Spectrum Jackpot. Atari Split-screen. TRS-80 Sound Synthesiser. 3D 'Bee. '64 Sprite Designer.

Volume 5 No. 4. 1984

Benchtests: Macintosh. Spectravideo/Checkouts: IBM Portable PC. Unix. Visiword Plus. Spectravideo/Teach Yourself Assembler. Part 2/Basic Program Conversion. Part 4: TRS-80 and Apple II graphics/Sharp PC1500 game scoring listing/Interview: Bill Gates of Microsoft/Microchess: 4th World Chess Championship results/Inside Atari's research laboratory/Programs:(Microsoft Basic) Inlay Cards. BBC Splash!. VIC 20 Invaders. Commodore 64 Reversi. VZ-200 Moon Lander. ('64) Gary the Guitar.

Volume 5 No. 5. 1984

Benchtests: Hewlett Packard 150 Touch Screen. Dick Smith Challenger. Canon X-07/Checkouts: Revelation. Concurrent CP/M. StarBurst and StarIndex. Sendata modem. Commodore SFD 1001 disk drive. Brother EP44 personal typewriter/Basic Program Conversion. Part 5: Atari/Compaction techniques. examples in Commodore Basic/Teach Yourself Assembler. Part 3/Text vs Graphics adventures/Operating Systems. Part 1/Microchess: Superstar vs Constellation/Programs: '64 Plane Attack. Commodore Wordsquare. Atari Flash Simulator. Atari Pseudo-Dos. Sord M5 Charpatt. VIC 20 Ape King. MicroBee Hires Editor. Apple II Oisterads. 'Bee Label Printer.

Volume 5 No. 6. 1984

Benchtest: Sharp PC5000/Checkouts: Codewriter. Microsoft Word. Dick Smith Cat. Apple ProDos. Knowledgeman. Autocad/Play Battleships on two Commodore computers/The History of the Keyboard/Teach Yourself Assembler. Part 4/Artificial Intelligence: a report from Japan/Basic Program Conversion. Part 6: Spectrum/Spectrum "wide screen" word processing/Software Copyright: the debate/The dangers of reviewing software/Programs: TRS-80 Compiler. TRS-80 Braille Writer. VIC 20 Deathwall. Basic-86 Marvin. PET 3D O's & X's. Five W 'Bee.

Volume 5 No. 7. 1984

Benchtest: Epson PX-8/Checkouts: Memotech. Framework. HP Ink Jet Printer. Expert-Ease. Apple's Instant Artist/Teach Yourself Assembler. Part 5/Operating Systems. Part 2/Designing and selling programs. Part 1/Calling routines available in CP/M/The story behind MSX/Basic Program Conversion. Part 7: BBC/Programs: '64 Balloon. Atari Function Keys. BBC Seeted. MicroBee Slalom. VZ-200 Blockout. '64 Split Screen Graphics. VIC 20 Monster Hunt.

Volume 5 No. 8. 1984

Benchtest: Sinclair QL/Checkouts: Perfect Link. Friday!. Knowledgeman (Part 2). PlanStar. Commodore 64 Flight Simulator. Constellation. Pick/Modem protocols: XModem/Exploring WordStar/Input and Output on the Atari/$25,000 competition: Brun's Constant/Teach Yourself Assembler. Part 6/Designing and selling programs. Part 2/Teach Yourself Lisp. Part 1/Detente between DP departments and standalone users — the Information Centre/Programs: VIC Hatchery. BBC RAM Editor. VIC 20 Life Game. Commodore 64 Connect-Four (note correction to this program in Bludners Vol 5 No. 10. 1984). VZ-200 Database. TRS-80 Color Grafx Editor. Atari Basic System Reset.

Volume 5 No. 9. 1984

Benchtests: Hewlett Packard 110/Checkouts: Framework vs Symphony. overview: Portable Computers. Jane vs Appleworks. Pick/Profile: Wayne Wilson/Teach Yourself Lisp. Part 2/Logic of assembly language. written in convertible Basic/Teach Yourself Assembler. Part 7/Braindump: Defence of the Gotogoto Bird *(this is a really excellent one page article — Ed)*/Microchess: Cray Blitz vs David Levy/Programs: '64 Defuse. BBC Mindwaves. VIC 20 Gothic and Greek. '64 Brackets (an updated version appears on page 76 of Vol 5 No. 11. 1984). Spectrum File. VIC Star Scramble (note: a correction to this program appears in the Bludners section of Vol 5 No. 10. 1984).

Volume 5 No. 10. 1984

Benchtests: Commodore Plus/4. Osborne Encore/Checkouts: Model 100 disk drive and video interface. Open Access. GSX from Digital Research. Netcomm modem/Is this education software any good: opinion/DIY robotics for the BBC/Combining video and PC output on the one screen/Sorting useful-sized files without a disk/Bubble memory: has it been worth the wait/Teach Yourself Lisp. Part 3/Pirate Bulletin Boards/DIY PC-video connection/How to write great software. Part 1/Programs: Atari Autorun. Commodore 64 Basic Assembler. Apple II Menu. BBC Equation Solver. Commodore Honeypot. Atari Snake. Spectrum Voyager. VZ-200 Mini calc Spreadsheet (improved in Bludners Vol 5 No. 12. 1984). IBM PC Microcomputer Graphics. Animated '64. Spectrum Graphics and sound.

Volume 5 No. 11. 1984

Benchtest: Apricot F1/Checkouts: Olivetti M24. Sperry PC. ITT Xtra. Commodore 16. AAP's microwave news service/The demise of the philosophy of the scholar: opinion/Artificial Intelligence: mind over matter/DIY Micro Music Circuit (to plug into a parallel port)/Computer Musicians/Teach Yourself Lisp. Part 4/Compilers: How they work and how to buy the best/Improving Commodore 64 programming skills/How to write great software. Part 2/Molecular electronics/Programs: Commodore 64 Superfile. Commodore 64 Mouse Master. '64 Sprite Editor. BBC graphics compiler/interpreter. Spectrum Crib Player. VZ-200 MON-200. Duelling VICs.

Volume 5 No. 12. 1984

Benchtests: IBM PC AT. Sony's MSX machine/Checkouts: Digital Research GEM. TI Speech Command. dBase III. Sunol network/Natural language processing/An introduction to the 68000 processor/Running your own bulletin board/Teach Yourself Lisp. Part 5/DIY Speech Synthesiser/How to write great software. Part III/Upgrade VIC 20 programs to the '64/Programs: Spectravideo Spectra-draw. '64 Hi-res Plot. TRS080 Automatic Cassette Indexer. Tandy Color/Dragon 32 Brimstone Part One. Spectrum Life. DayFinder (written in Lisp). Commodore 64 Gremlin's Garden.

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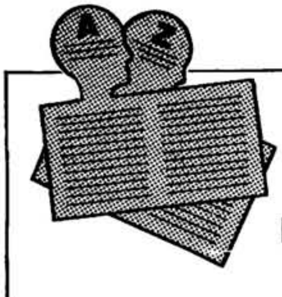

USER GROUPS

Below is a list of alterations and additions to the list of user groups published in the December issue of APC. The next full listing will appear in the April issue.

NEW SOUTH WALES

A new group called TAG (The Access Group) has been formed in Orange for Access and Actrix users. Not surprisingly, new members are needed urgently. Write to Bob Dolton at PO Box 943, Orange, 2800.

The Sydney Kaypro User Group meets at 8pm on the second Tuesday of each month at the Burwood RSL Club. Features of the Group include software and hardware assistance, tutorials, visiting speakers and a public domain software library. Write to PO Box 975, Chatswood, 2067.

Hewlett-Packard Series 40 and 70 and HP-IL users can phone Nigel Davies on (02) 560 7186 (AH) for details of the PPC/CHUU Sydney user group.

The BBC Micro Users Group can be contacted through Marie Michaels at Computer Medics, 5/647 Princes Highway, Blakehurst, 2221. Telephone (02) 546 5175.

The Hawkesbury MicroBee Computer Club serves the north western area of Sydney and can be contacted through its president Bruce Rennie on (045) 67 7329 (AH). General meetings are held on the first Friday of each month at 7.30pm and workshops on the third Friday of each month. Both are held in the library building at the Richmond High School, Cnr Penrith Road and Lennox Street, Richmond.

VICTORIA

The Eastern Suburbs Eighty Users' Group (ESEUG) meets on the fourth Wednesday of each month (except January and December) at the Junior Science Lab., Kingswood College, 355 Station Street, Box Hill at 7.15pm. Information regarding the club can be obtained by writing to ESEUG, C/- Cameron McKern, 21 Harrow Street, Box Hill 3128 or by ringing him on (03) 890 3088 (AH). Written queries are preferred. The Group caters for System 80/TRS-80 users.

The Computer Resources Group in Health Care arose out of the need to provide resource information about computers at a clinical level.

This group aims to provide a forum for health care workers, computing experts and interested others to enhance their knowledge and pool their skills and resources.

The next meeting of the Group in Health Care will be held on February 20 at 7.30 pm in Room 226 of the Lincoln Institute, 625 Swanston Street, Carlton. Call Johanne Bull on (03) 342 0244 for more details.

ACT

The Commodore User Group meets on the first Monday of each month at the Melba High School and on the third Monday of the month at Woden Town Centre Library. Contact can be made by writing to PO Box 599, Belconnen, 2616.

The Sirius/Apricot User Group meets at 7.30pm on the third Tuesday of each month at 88 Wollongong Street, Fyshwick. Correspondence should be addressed to M Sim, 253 Hindmarsh Drive, Rivett, 2611.

QUEENSLAND

A VZ-200 club has been formed by J D'Alton in Toowong. Interested parties should telephone (07) 371 3707 after hours.

The Atari Computer Enthusiasts group in Queensland can be contacted by writing to GPO Box 600, Brisbane, 4001.

NORTHERN TERRITORY

The CP/M Users' Group of Central Australia meets at 7.30pm on the second Thursday of each month at the Community College of Central Australia in Alice Springs. The contact is Susan Pemble, CUGCA, PO Box 795, Alice Springs 5750; (087) 52 7870.

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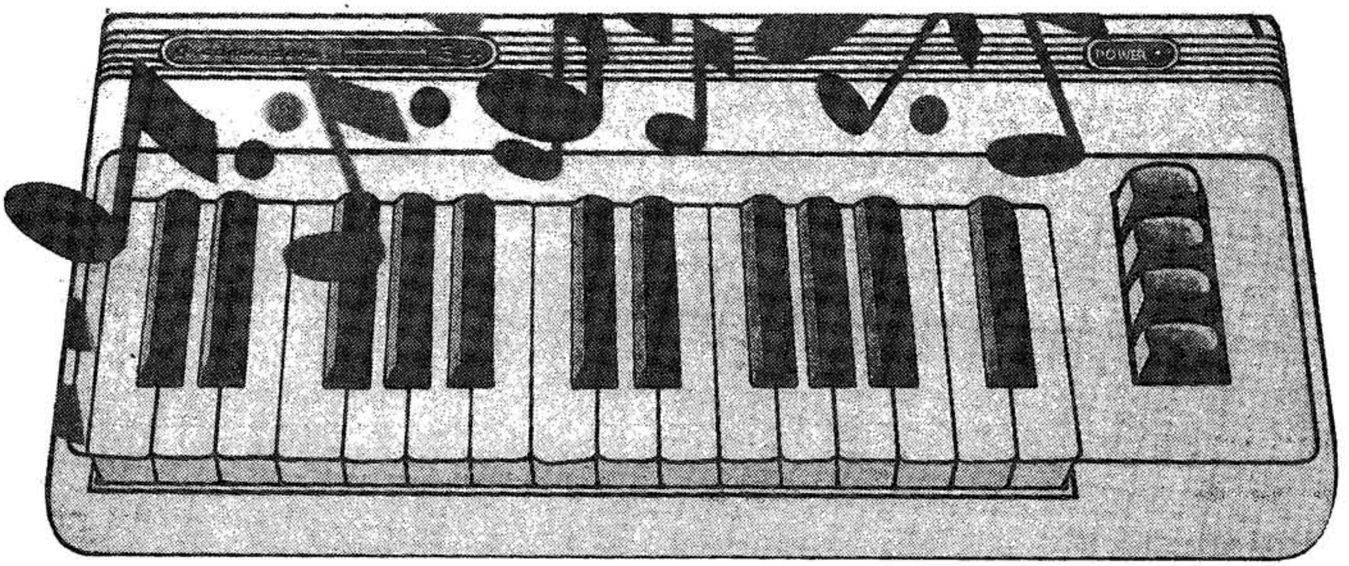

Play a three-part musical composition or jazz up your megagame via interrupts. Nick Higham's program shows you how it's done.

Many games for the Commodore 64 take advantage of its excellent sound chip (SID) by featuring a musical soundtrack, often full two- or three-part arrangements. Home users who want to add musical accompaniment to their own programs encounter difficulties, since concurrent music and screen activity can only be obtained with machine code.

With this listing you can key in a machine code program for playing three-part music on the 64 which allows the computer to carry on with other tasks while the music is playing. This is achieved by playing the music via the interrupts.

The program can easily be incorporated into your own software, to add music to a game written in Basic, or perhaps to play three-part musical compositions. In the latter case, interesting effects can be obtained by changing the SID chip registers from Basic while the music is playing — in fact, experimenting in this fashion is probably the easiest way to learn about the SID chip if you don't have one of the excellent commercial music programs available for the 64.

The interrupts

In order to understand how the musical interrupt technique works, it is necessary to know some basic facts about the Commodore 64's interrupts. Fifty times a second the 64's 6510 processor suspends its current activity and executes code at the location specified by the interrupt vector, which is stored in RAM at locations $0314 and $0315 (788 and 789).

Normally the interrupt vector points to address $EA31, the beginning of a routine in the KERNAL ROM that performs the 64's housekeeping operations, such as the real-time clock and scanning the keyboard.

However, you can alter the interrupt vector to make it point to one of your own machine code routines, in this case to send instructions to the SID chip. As long as we jump to $EA31 at the end of our routine, the 64 will carry on processing, oblivious to the extra work that it is performing.

The assembler program in Listing 1 contains the necessary machine code routines for playing three-part music. The object code occupies about 280 bytes and is stored in the spare 4k of RAM at $C000.

There are four parts to the program: a routine to install a new interrupt vector that points to the music routine (WEDGEON at line 815) and one to restore the old interrupt vector, for use when the music is not longer required (WEDGEOFF at line 890); a routine to turn the music on (MUSICON at line 2010); and the main section of code (WEDGE at line 1000) which plays the music.

How it works

The WEDGE routine first examines location $C000 (49152). A zero here indicates that music is off, in which case control is returned immediately to the standard interrupt routine. This music can be turned on and off by poking 49152 with 1 and 0 respectively.

Similarly $C001-$C003 (49152-49155) indicate which of the SID chip's three voices is to be played. You can use any combination of the three voices, which is useful as you may want to reserve one sound channel for special effects, produced in the normal way from the host program.

The loop from lines 1150 to 1490 services each active voice. It determines whether the current note for each voice has finished, and if it has, fetches the next note and duration from the storage area, sets up the voice's frequency registers in the SID chip, and gates the oscillator.

The notes are stored in separate blocks, one for each voice, in groups of three bytes of the form duration, frequency low-byte, frequency high-byte. Thus a C note in octave 4 of duration four beats is represented by '4,37,17' (see the Commodore 64 User's Guide).

The notes can be stored anywhere in memory and there is no limit to the number allowed, but the starting addresses of the blocks must be stored at locations $C005-$C00A (49157-49162), in low/high-byte form.

Note that the three starting addresses can be the same, causing the voices to play in unison. Try starting addresses differing by 3, 6, 9 etc in order to play a canon. Once all the notes for a given voice have been played that voice starts again.

The tempo of the music is controlled by location $C004 (49156). A ten in here, for example, causes each beat to last for ten interrupts, or one fifth of a second.

The final piece of information that the program needs to know is the contents of the control registers for each voice — this detemines the waveform, the selection of synchronisation and ring modulation effects (refer to the Programmer's Reference Guide for details). The values should be placed at addresses $C00B-$C00d (49163-49165).

For those who don't have an assembler, or who prefer not to enter the source code, listing 2 gives a Basic loader which pokes in the machine code from data statements and then plays a demonstration — a three-part arrangement of the *Passion Choral*. The program takes about six seconds to run; when it has finished you have full control over the computer for programming — with a soothing musical accompaniment.

The program given here can easily be incorporated into another piece of software, for example a game. The most difficult task will be the setting up of the music data, which is rather tedious and error-prone, unless you use a sophisticated program such as Supersoft's *Music Master*, whose music files can be read and converted into the required form.

For more impressive musical arrangements it is useful to be able to change the tempo, waveforms, envelopes and volume while the music is playing. This can be done by specifying blocks of data of the form (waveforms 1-3, envelopes 1-3, tempo, volume, number of beats). Add extra code to the WEDGE routine to count for the requisite number of beats and install the new parameters.

Listing 1

```
100 REM BASIC LOADER FOR INTERRUPT DRIVEN 3-PART MUSIC ON THE CBM 64
110 REM BY NICK HIGHAM
120 :
500 T=0:FORI=49152 TO 49431:READZ:T=T+Z:POKEI,Z:NEXT
510 IF T<> 32881 THEN PRINT"CHECKSUM ERROR: CHECK DATA STATEMENTS":END
550 :
1000 REM DATA FOR MACHINE CODE
1005 :
1010 DATA 0,1,1,1,10,0,160,0,160,0,160,32,32,32,0,0
1020 DATA 0,0,7,14,0,0,49,234,173,20,3,201,79,208,8,173
1030 DATA 21,3,201,192,208,1,96,120,173,20,3,141,22,192,173,21
1040 DATA 3,141,23,192,169,79,141,20,3,169,192,141,21,3,88,96
1050 DATA 120,173,22,192,141,20,3,173,23,192,141,21,3,88,96,173
1060 DATA 0,192,208,3,108,22,192,206,21,192,240,3,108,22,192,173
1070 DATA 4,192,141,21,192,169,2,141,20,192,174,20,192,189,1,192
1080 DATA 240,57,222,14,192,208,52,189,11,192,41,254,188,17,192,153
1090 DATA 4,212,138,10,170,32,223,192,240,41,172,20,192,153,14,192
1100 DATA 185,17,192,168,32,223,192,153,0,212,32,223,192,153,1,212
1110 DATA 174,20,192,189,11,192,9,1,153,4,212,206,20,192,16,186
1120 DATA 108,22,192,189,5,192,149,247,189,6,192,149,248,161,247,208
1130 DATA 201,181,247,208,2,214,248,214,247,169,255,172,20,192,153,14
1140 DATA 192,185,17,192,168,169,0,153,0,212,153,1,212,240,204,246
1150 DATA 247,208,2,246,248,161,247,96,169,0,141,0,192,162,2,138
1160 DATA 10,168,56,185,5,192,233,1,153,247,0,185,6,192,233,0
1170 DATA 153,248,0,202,16,233,169,1,141,14,192,141,15,192,141,16
1180 DATA 192,141,21,192,141,0,192,96
1190 :
1195 :
40000 REM -- DEMONSTRATION --
40005 REM 3-PART ARRANGEMENT OF PASSION CHORAL
40010 LOC=49152
40012 :
40014 REM ALL THREE VOICES ON
40015 FORI=LOC+1TOLOC+3:POKEI,1:NEXT
40016 :
40017 REM START OF CHANNEL POINTERS
40020 FORI=LOC+5 TO LOC+10:READX:POKEI,X:NEXT
40030 DATA 0,200,169,200,118,201
40035 :
40037 REM ALL VOICES TRIANGLE WAVEFORM
40040 FOR I=LOC+11 TO LOC+13:POKEI,16:NEXT
40045 :
40048 REM TEMPO
40050 POKE LOC+4,18
40055 :
40060 REM ADSR=0/12/0/0, VOLUME=8
40070 SID=54272:FORI=0TO14STEP7:POKE SID+5+I,11:POKESID+6+I,0:NEXT
40080 POKE SID+24.8
40090 :
40095 REM POKE IN THE MUSIC DATA
40100 FORI=51200 TO 51778:READX:POKEI,X:NEXT
40120 :
40130 REM PARAMETERS AND DATA INSTALLED - NOW PLAY THE MUSIC
40140 SYS 49176: REM WEDGEON
40150 SYS 49384: REM MUSICON
40160 :
40170 END: REM CARRY ON PROGRAMMING!
40180 :
50000 REM DATA FOR PASSION CHORAL
50005 :
50010 DATA 2,238,21,2,70,29,2,20,26,2,60,23,2,238,21,4
50020 DATA 138,19,2,238,21,2,220,32,2,208,34,2,208,34,1,220
50030 DATA 32,1,70,29,2,220,32,6,70,29,2,238,21,2,70,29
50040 DATA 2,20,26,2,60,23,2,238,21,4,138,19,2,238,21,2
50050 DATA 220,32,2,208,34,2,208,34,1,220,32,1,70,29,2,220
50060 DATA 32,6,70,29,2,208,34,1,220,32,1,70,29,2,20,26
50070 DATA 2,70,29,2,220,32,4,208,34,2,208,34,2,20,26,2
50080 DATA 70,29,2,20,26,2,60,23,2,60,23,6,238,21,2,208
50090 DATA 34,1,220,32,1,208,34,2,19,39,2,208,34,2,220,32
50100 DATA 4,70,29,2,220,32,2,238,21,2,60,23,2,238,21,2
50110 DATA 138,19,2,20,26,6,238,21,0,2,104,17,2,104,17,2
50120 DATA 104,17,1,104,17,1,137,19,1,137,19,1,104,17,2,104
50130 DATA 17,2,110,16,2,104,17,2,137,19,1,104,17,1,137,19
50140 DATA 2,238,21,2,238,21,1,238,21,1,137,19,6,104,17,2
50150 DATA 104,17,2,104,17,2,104,17,1,104,17,1,137,19,1,137
50160 DATA 19,1,104,17,2,104,17,2,110,16,2,104,17,2,137,19
50170 DATA 1,104,17,1,137,19,2,238,21,2,238,21,1,238,21,1
50180 DATA 137,19,6,104,17,1,70,29,1,20,26,2,60,23,1,238
50190 DATA 21,1,137,19,2,104,17,2,60,23,2,60,23,1,238,21
50200 DATA 1,137,19,2,238,21,2,238,21,2,60,23,2,238,21,2
50210 DATA 238,21,2,137,19,6,113,18,2,137,19,2,137,19,2,137
50220 DATA 19,2,238,21,2,137,19,2,238,21,2,137,19,2,137,19
50230 DATA 2,104,17,1,104,17,1,110,16,2,104,17,2,104,17,2
50240 DATA 110,16,6,104,17,0,2,10,13,2,158,11,2,10,13,1
50250 DATA 163,14,1,10,13,2,10,13,2,163,14,2,10,13,2,10
50260 DATA 13,2,208,13,2,247,10,2,163,14,2,163,14,2,208,13
50270 DATA 6,163,14,2,10,13,2,158,11,2,10,13,1,163,14,1
50280 DATA 10,13,2,10,13,2,163,14,2,10,13,2,10,13,2,208
50290 DATA 13,2,247,10,2,163,14,2,163,14,2,208,13,6,163,14
50300 DATA 2,238,21,1,137,19,1,104,17,2,110,16,1,163,14,1
50310 DATA 10,13,1,158,11,1,10,13,2,163,14,1,10,13,1,158
50320 DATA 11,2,10,13,2,104,17,2,104,17,1,104,17,1,110,16
50330 DATA 2,163,14,2,163,14,6,163,14,2,163,14,2,10,13,1
50340 DATA 10,13,1,79,12,1,10,13,1,163,14,1,110,16,1,10
50350 DATA 13,1,247,10,1,163,14,2,79,12,2,10,13,2,10,13
50360 DATA 2,158,11,2,10,13,2,163,14,1,197,9,1,10,13,6
50370 DATA 10,13,0
```

Listing 2 *The accompanying programs can be amended to allow the use of a musical keyboard.*

```
  10 033C          ! INTERRUPT DRIVEN 3-PART MUSIC FOR THE CBM 64
  15 033C          !
  20 033C          ! BY NICK HIGHAM
  30 033C          !
  50 033C          ! MIKRO ASSEMBLER (SUPERSOFT) SOURCE CODE
 100 033C          !
 110 C000          *=$C000
 160 C000          !
 170 C000          ! TO USE:
 172 C000          !
 175 C000          ! CALL <WEDGEON> TO ACTIVATE THE INTERRUPT WEDGE
 180 C000          ! CALL <MUSICON> TO START (OR RESTART) THE MUSIC
 185 C000          ! POKE FLAG,0 TO HALT MUSIC
 190 C000          ! POKE FLAG,1 TO CONTINUE MUSIC
 195 C000          ! CALL <WEDGEOFF> TO REMOVE THE WEDGE
                   FROM THE INTERRUPT
 200 C000          !
 290 C000          !----------------------------------
```

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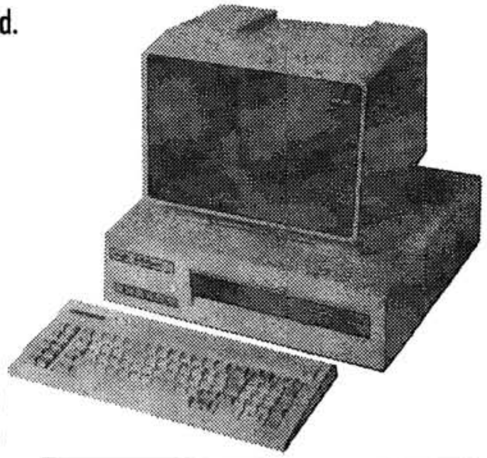

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```
292 C000               !
295 C000             ! THE FOLLOWING PARAMETERS ARE TO BE SET BY THE USER
300 C000               !
310 C000 00            FLAG           0          ! MUSIC OFF=0, ON=1
320 C001 01            FLAG1      BYT 1          ! DEFAULT:ALL VOICES ON
330 C002 01            FLAG2      BYT 1
340 C003 01            FLAG3      BYT 1
342 C004               !
344 C004 0A            TEMPO      BYT 10               ! 0<=TEMPO<=255
346 C005               !
347 C005               ! POINTERS TO START OF NOTES FOR EACH CHANNEL
348 C005               !
350 C005 00            LOW1       BYT $00              ! DEFAULT:PLAY
351 C006 A0            HIGH1      BYT $A0              ! BASIC ROMS
352 C007 00            LOW2       BYT $00
353 C008 A0            HIGH2      BYT $A0
354 C009 00            LOW3       BYT $00
355 C00A A0            HIGH3      BYT $A0
356 C00B               !
357 C00B               ! MUSIC DATA MUST BE STORED IN MEMORY AT ADDRESSES
358 C00B               ! (LOW1), (LOW2), (LOW3).
360 C00B               ! EASIEST TO USE MUSIC MASTER (SUPERSOFT)
361 C00B               ! OR MUSICALC TO GENERATE THE DATA.
364 C00B               !
365 C00B 20            CREGVAL1   BYT 32               ' SAWTOOTH
370 C00C 20            CREGVAL2   BYT 32
380 C00D 20            CREGVAL3   BYT 32
390 C00E               !
395 C00E               !-----------------------------------
397 C00E               !
400 C00E 00            ELAPSE1    BYT 0
410 C00F 00            ELAPSE2    BYT 0
420 C010 00            ELAPSE3    BYT 0
440 C011               !
450 C011 00070E OFFSET            BYT 0,7,14      ! FOR VOICE REGISTERS
530 C014               !
540 C014 00            VOICE      BYT 0
560 C015 00            COUNTDOWN  BYT 0
570 C016               !
600 C016               SID         =  54272
610 C016               CTRLREG1    =  SID+4
620 C016               !
630 C016               ! SAFE ZERO-PAGE LOCATIONS
635 C016               !                   (ASSUMING RS-232 NOT IN USE)
640 C016               LOWPTR1     =  247
650 C016               HIGHPTR1    =  248
660 C016               LOWPTR2     =  249
670 C016               HIGHPTR     =  250
680 C016               LOWPTR3     =  251
690 C016               HIGHPTR3    =  252
790 C016               !
800 C016 31EA          OLDIRQ     WOR $EA31
805 C018               IRQVECTOR   =  $0314
810 C018               !
812 C018               !-----------------------------------
814 C018               !
815 C018 AD1403 WEDGEON         LDA IRQVECTOR   IS WEDGE SET ALREADY?
816 C01B               !######
818 C01B C94F                   CMP #<WEDGE
819 C01D D008                   BNE NEEDSDOING
820 C01F AD1503                 LDA IRQVECTOR+1
821 C022 C9C0                   CMP #>WEDGE
822 C024 D001                   BNE NEEDSDOING
823 C026 60                     RTS
824 C027               !
825 C027 78            NEEDSDOING  SEI
828 C028 AD1403                 LDA IRQVECTOR   ! SAVE OLD VECTOR
830 C02B 8D16C0                 STA OLDIRQ
835 C02E AD1503                 LDA IRQVECTOR+1
840 C031 8D17C0                 STA OLDIRQ+1
845 C034               !
850 C034 A94F                   LDA #<WEDGE     ! SET UP NEW VECTOR
855 C036 8D1403                 STA IRQVECTOR
860 C039 A9C0                   LDA #>WEDGE
865 C03B 8D1503                 STA IRQVECTOR+1
870 C03E 58                     CLI
875 C03F 60                     RTS
885 C040               !
890 C040 78            WEDGEOFF    SEI
895 C041               !#######
900 C041 AD16C0                 LDA OLDIRQ
905 C044 8D1403                 STA IRQVECTOR
910 C047 AD17C0                 LDA OLDIRQ+1
915 C04A 8D1503                 STA IRQVECTOR+1
920 C04D 58                     CLI
925 C04E 60                     RTS
985 C04F               !
990 C04F               ! THE MAIN ROUTINE, CALLED ON EACH INTERRUPT
995 C04F               !
1000 C04F AD00C0 WEDGE          LDA FLAG
1010 C052              !####
1020 C052 D003                  BNE ON
1030 C054 6C16C0                JMP (OLDIRQ)
1040 C057              !
1050 C057 CE15C0 ON             DEC COUNTDOWN
1060 C05A F003                  BEQ NEXTBEAT
1070 C05C 6C16C0                JMP (OLDIRQ)
1080 C05F              !
1083 C05F              ! BEGINNING OF A NEW BEAT.
1085 C05F              ! RESET COUNTDOWN THEN DEAL WITH EACH VOICE IN TURN.
1086 C05F              !
1090 C05F AD04C0 NEXTBEAT       LDA TEMPO
1100 C062 8D15C0                STA COUNTDOWN
1110 C065              !
1120 C065 A902                  LDA #2
1130 C067 8D14C0                STA VOICE
1140 C06A              !
1150 C06A AE14C0 LOOPVOICE      LDX VOICE         ' FOR VOICE = 3,2,1
1160 C06D BD01C0                LDA FLAG1,X
1170 C070 F039                  BEQ NEXTVOICE     ! VOICE OFF?
1180 C072 DE0EC0                DEC ELAPSE1,X
1190 C075 D034                  BNE NEXTVOICE     ! END OF NOTE?
1200 C077              !
1210 C077 BD0BC0                LDA CREGVAL1,X
1215 C07A 29FE                  AND #254          ' CLEAR GATE BIT
1220 C07C BC11C0                LDY OFFSET,X
1230 C07F 9904D4                STA CTRLREG1,Y    ! GATE OFF
1240 C082              !
1250 C082 8A                    TXA
1260 C083 0A                    ASL A
1270 C084 AA                    TAX               ' X= 4,2 OR 0
1280 C085              !
1290 C085 20DFC0                JSR GETBYTE       ' GET DUR. OF NEW NOTE
1300 C088 F029                  BEQ ENDOFNOTES
1310 C08A              !
1320 C08A AC14C0 RESETCOUNT     LDY VOICE
1330 C08D 990EC0                STA ELAPSE1,Y     ! COUNT FOR NEW NOTE
1340 C090              !
1350 C090 B911C0                LDA OFFSET,Y
1360 C093 A8                    TAY
1370 C094              !
1375 C094              ! FETCH AND INSTALL FREQUENCY
1377 C094              !
1380 C094 20DFC0                JSR GETBYTE
1390 C097 9900D4                STA SID,Y
1400 C09A 20DFC0                JSR GETBYTE
1410 C09D 9901D4                STA SID+1,Y
1420 C0A0              !
1430 C0A0 AE14C0                LDX VOICE
1440 C0A3 BD0BC0                LDA CREGVAL1,X
1450 C0A6 0901                  ORA #1            ! SET GATE BIT
1460 C0A8 9904D4                STA CTRLREG1,Y    ! GATE ON
1470 C0AB              !
1480 C0AB CE14C0 NEXTVOICE      DEC VOICE
1490 C0AE 10BA                  BPL LOOPVOICE
1500 C0B0 6C16C0                JMP (OLDIRQ)
1510 C0B3              !
1520 C0B3 BD05C0 ENDOFNOTES     LDA LOW1,X            ! RESET POINTERS TO
1530 C0B6 95F7                  STA LOWPTR1,X         ! FIRST NOTE
1540 C0B8 BD06C0                LDA HIGH1,X
1550 C0BB 95F8                  STA HIGHPTR1,X
1560 C0BD              !
1570 C0BD A1F7                  LDA (LOWPTR1,X)
1580 C0BF D0C9                  BNE RESETCOUNT        ' DURATION NONZERO?
1590 C0C1              !
1595 C0C1              ' DEAL WITH A VOICE WHICH IS TURNED ON
1597 C0C1              ! BUT HAS NO NOTES TO PLAY
1598 C0C1              !
1600 C0C1 B5F7                  LDA LOWPTR1,X
1605 C0C3 D002                  BNE L1
1610 C0C5 D6F8                  DEC HIGHPTR1,X
1615 C0C7 D6F7   L1             DEC LOWPTR1,X
1640 C0C9              !
1650 C0C9 A9FF                  LDA #255
1660 C0CB AC14C0                LDY VOICE
1670 C0CE 990EC0                STA ELAPSE1,Y         ' REST FOR 255 BEATS
1680 C0D1 B911C0                LDA OFFSET,Y
1690 C0D4 A8                    TAY
1700 C0D5 A900                  LDA #0
1710 C0D7 9900D4                STA SID,Y
1720 C0DA 9901D4                STA SID+1,Y
1730 C0DD F0CC                  BEQ NEXTVOICE         ! ALWAYS
1740 C0DF              !
1750 C0DF              !
1930 C0DF              'INCREMENT POINTER BY ONE AND GET THE BYTE POINTED TO
1935 C0DF              !
1940 C0DF F6F7   GETBYTE        INC LOWPTR1,X
1950 C0E1              '######
1960 C0E1 D002                  BNE NOCARRY
1970 C0E3 F6F8                  INC HIGHPTR1,X
1980 C0E5 A1F7   NOCARRY        LDA (LOWPTR1,X)
1990 C0E7 60                    RTS
2000 C0E8              !
2005 C0E8              ' PREPARE TO PLAY THE MUSIC - SET UP
2007 C0E8              ' POINTERS AND COUNTERS
2008 C0E8              !
2010 C0E8 A900   MUSICON        LDA #0
2020 C0EA              '######
2030 C0EA 8D00C0                STA FLAG              ' MUSIC OFF
2040 C0ED A202                  LDX #2
2042 C0EF              !
2045 C0EF 8A     LOOPCOPY       TXA
2050 C0F0 0A                    ASL A
2055 C0F1 A8                    TAY
2060 C0F2              !
2065 C0F2 38                    SEC
2070 C0F3 B905C0                LDA LOW1,Y
2075 C0F6 E901                  SBC #1
2077 C0F8 99F700                STA LOWPTR1,Y
2080 C0FB B906C0                LDA HIGH1,Y
2085 C0FE E900                  SBC #0
2090 C100 99F800                STA HIGHPTR1,Y
2095 C103 CA                    DEX
2100 C104 10E9                  BPL LOOPCOPY
2105 C106              !
2106 C106              ' NEW BEAT, AND NEW NOTE FOR EACH VOICE,
2107 C106              ' ON THE 'FIRST' INTERRUPT.
2108 C106              !
2110 C106 A901                  LDA #1
2120 C108 8D0EC0                STA ELAPSE1
2130 C10B 8D0FC0                STA ELAPSE2
2140 C10E 8D10C0                STA ELAPSE3
2150 C111 8D15C0                STA COUNTDOWN
2160 C114 8D00C0                STA FLAG                  TURN MUSIC ON
2170 C117 60                    RTS
```

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This is the chance to air your views — send your letters to 'Communications', Australian Personal Computer, 77 Glenhuntly Road, Elwood, Victoria 3184. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

Basic understanding

I have come to the conclusion that although people want more software written for their particular micro, nobody is prepared to give away any secrets, so that more up-and-coming programmers can have a better understanding of the way a certain problem is solved by a computer.

In a previous edition of *APC*, in the Communications section, there was a cry of despair from a VZ-200 user for a word processor type program for the VZ-200. On reading through the Programs section of a few *APC* issues, it is easy to see why nobody (novices) can write programs for the VZ-200. It appears that those who know the deep dark secrets of programming would like to keep these secrets to themselves.

All of the programs that I have seen in *APC* for the VZ-200, have had no comments (apart from those with the authors name etc) in them. It doesn't take long to add a few comments into a program just to let the reader know what the program is doing. For example the following code is from a Basic program:

```
210 CLS:PRINT"RECORD NUMBER:";NF%+1:PRINT
220 FORL1=1TONR%:PRINTRN$(L1,1);:INPUTRC$(L1,NF%+1)
230 IF(L1=1)AND(RC$(L1,NF%+1)="")THENRETURN
240 NEXT:NF%=NF%+1:IFNF%<50THEN200
250 PRINT"DATABASE FULL!!!":FORL1=1TO1000:NEXT:RETURN
400 CLS:INPUT"WHAT RECORD";NU%
410 IF(NU%>NF%)OR(NU%<0)THEN400
420 IFNU%=0THENRETURN
430 ......e.t.c.
```

Wouldn't it be a lot easier to see what the program is doing (apart from spending hours tracing through it) if it were presented in the following form:

```
198 REM  ************************************
199 REM  ***         ADDING A RECORD        ***
210 CLS:PRINT .......e.t.c.
260 REM  ***         END OF ADDITION        ***
261 REM  ************************************
399 REM  ***        CHANGING A RECORD       ***
400 CLS:INPUT .......e.t.c.
```

At least from there, the reader can see what the particular section of a program is doing; then if they want to go into any more detail, they can use their Basic reference manual. It also helps if there is a list of the variables (in REM statements), and what each variable is used for, at the beginning of the program. Another tip is to use variables that represent something. In the example, NU% is for NUmeric storage, NR% is for Number of Records, L1 is for a Loop (there are three of these in the program, L1 . . . L3), and RC$ stands for Record Contents.

Some readers may think this all a gross waste of time and effort, but if their little micros ever acquire the capability of running other high level languages (eg, Pascal, Cobol), they will see why this is a good practice to get in to.

There is no need to go overboard with the comments, but imagine a beginner in this wondrous field of computing, sitting there with his/her reference manual, and trying to figure what the heck is going on in the first lot of code or what part of the program it is. I have visions of a 12/13 year old in tears, ripping up the manual, pulling the plug on the computer and vowing never to use it again.

If we want this industry to grow, lets share the secrets around so that the up and coming youngsters have the opportunity of learning from things that we had to find out for ourselves.

S Hobson

WordStar below par

In your October issue's 'Teach Yourself Lisp' series, Dick Pountain makes the *amazing* assertion that 'Lisp people tend to be spartan, almost monastic souls, unspoiled by full-screen editors . . .

Boy, has he got it wrong!

Poor souls who struggle with Lisp on personal machines may think WordStar is good, but those who use real Lisp systems like InterLisp, MacLisp, and so on would liken using WordStar to using a hand calculator.

Their editors are probably the most sophisticated in the world: they'll automatically indent functions for legibility as they are typed in, balance brackets for you, and move whole nested brackets expressions about as one piece. Add to that the fact that they'll let you work with several files at once, each in its own window.

They'll also automatically draw up calling trees (the Lisp equivalent of flow charts) of the routine you're using *and all those called by any it calls.* And if you ask them nicely, they'll even go away and find out where the function you are working with is called, and show you each call in turn. And all these functions are called up by a mouse . . .

I don't think WordStar is quite up to that lot, is it?

Robert Inder

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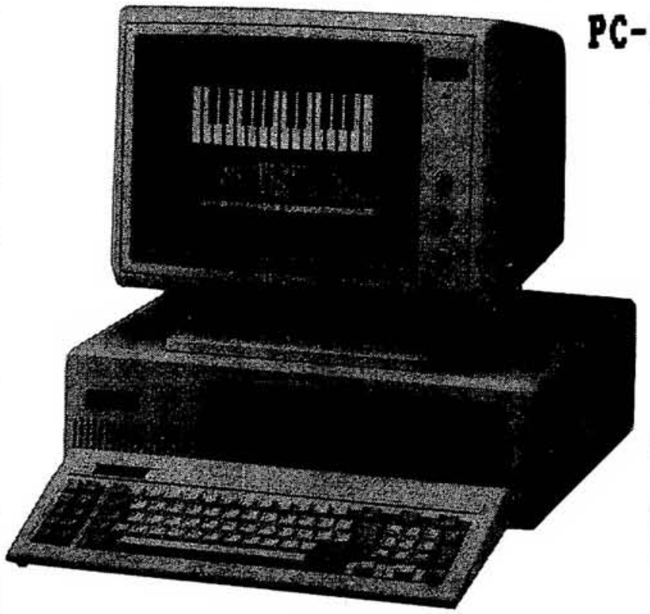

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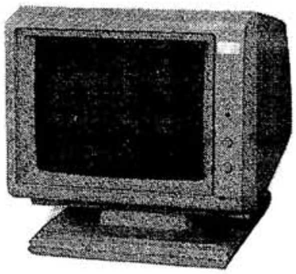

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Fighting off the Japs

Nobody can ignore the fact that the Japanese MSX micros have finally arrived. Although they are clearly overpriced, prices will no doubt fall in time. Their standard may at first appear a boon, but I believe that it's probably their downfall. When you strip a micro down, what is it? The processor, the Basic, sound, graphics and interfaces. If you standardise these things, what are you left with? The same machine in a different coloured box. There will be small variations: different keyboard layout, printer ports in different places, and so on. But the result could be that instead of choosing between, say, a Spectrum, a Commodore, a Goldstar MSX, Hitachi MSX and Toshiba MSX, the choice would be between a Spectrum, a Commodore and MSX. Once the choice for MSX is made then the choice of *which* MSX is made.

So, instead of the market being divided into sixths it will be divided into quarters. This would mean that MSX companies will have to share a quarter between, say, 10 companies and the likes of Commodore will get a full quarter.

While Toshiba and Hitachi can put up with a reduced share of the market they will not have the same punch as was expected. This may cause some of the smaller companies to pull out of the market or go under.

A Kelly

Spanish solution

It is with some consternation that we read of the suggested "solution" to the question of Spanish word processing in your column (Viva Espana!, December). The Digital Rainbow has a full multinational character set which includes special western European characters, including Spanish, viz:

á, ç, è, î, ñ, ö, ¿, ¡, etc.

These characters are obtained via the "Compose Character" key and are displayed on the screen. They all have the eighth bit set, ie, their decimal codes are from 128-256, whereas normal ASCII is from 0-127.

Furthermore, the Digital LA50 and LA100 printers can print these characters (hence their appearance in this letter). The LA100 also has multiple character fonts which should satisfy the need for italics. The only problem may be getting a complete system for $6000.

As far as word processing is concerned, we sell a screen editor called µ-EDT which is capable of using these characters, but it is not a word processor. However, we believe that the SELECT word processor sold by Digital will probably work, but WordStar may not because it uses the eighth bit.

Denise Taylor
Microcomputer Technology

Catch 64

I have read that interpreted Basic programs on the IBM PC are limited to a total size of 64k for the program and data. What's the point of buying, say, a 128k machine if a program has to fit into 64k? Do dBase II or dBase III have similar limitations? I'm trying to decide on a language to develop programs for business use.

J Norris

You're quite right. Both MBasic and dBase II allow a maximum of 64k for programs and data; if you're only going to use these languages, there's not much point in buying extra memory.

The 64k limit exists because both MBasic and dBase II are translations of programs for smaller (CP/M) micro systems which only support 64k. The changes necessary to make use of the extra RAM are quite major, partly because of the way the programs are designed and partly because of the messy way the 8088 processor handles extra memory. It works with 64k 'segments', and special machine instructions are needed to switch from one segment to the next.

The extra RAM will come in useful if you purchase a word processor or other package written specially for the IBM machine. New programs (such as Lotus 1-2-3 and Symphony) make use of all the free memory. Most language compilers allow you to use two 64k areas — one for data, and one for the program.

Remember that this 64k limitation only applies to the information in the computer's memory at any instant. It's possible to 'overlay' programs and data from the disk drives, and swap them back and forth so that their total size can be much greater than 64k.

SG

VIC 20 jumps!

I have recently advanced into the world of machine code on my VIC 20, but I don't fully understand the counting of byte numbers when using jumps. Can you help?
Paul McLeod

This seems to be the all-time favourite question among learner programmers — 6502, 6809 or Z80? All these machines use a technique called 'relative jumping' or 'branching', which is very useful but can be a little difficult to understand.

Most branch instructions consist of two bytes. The first tells the computer that a branch may be needed — perhaps only under certain circumstances: for example, if the least result were zero, or overflowed. The second byte tells the computer where to go if the circumstances are right — whether to go back or forward in the program, and how far back or forward to go. If the conditions are not *right, the program just carries on with the instruction immediately after the branch instruction.*

The topic is confusing because of the way that the new destination is specified — using something called a 'two's complement relative offset'.

A 'relative offset' is just a distance, in bytes, from one instruction to another. If one instruction is at location 100 and the other is at 87, the relative offset is 13 bytes.

The 'two's complement' part just means that the destination can be either side of the start — earlier or later in memory it's easy enough to represent a jump three bytes ahead — the relative offset is three, so that such a jump skips over three bytes. The code would be:

```
<jump byte>
<offset 3>
<skipped 1>
<skipped 2>
<skipped 2>
<carry on>
```

The computer executes this by finding the jump byte at the start, and then looking for the 'offset' which follows it: this is the value 3. The next byte the computer looks at is called 'skipped 1', but the branch instruction tells it to add an offset of 3 to 'where it is looking'. The result is that three bytes are skipped, and execu-

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tion continues at 'carry on'.

Notice that the 'relative offset' is relative to the byte after *the jump instruction, not relative to the start of the jump instruction. People often forget this. In relative jumps and branches the 'offset' is the number of bytes skipped,* not *the distance between the start and the destination.*

We now have a system for skipping over any number between 0 and 255 bytes. In practice it's useful to be able to jump backwards as well as forwards. The answer is to allow values from 0 to 127 to represent forward jumps, and 128 to 255 to represent backward ones.

But here things get confusing, because we can't put negative values in a byte: we need to represent negative values from −1 to −128. The way we do it seems odd, but it keeps the processor simple. To convert a negative value between −1 and −128 into a positive value between 128 and 256, we add 256 to the negative version. To jump back four bytes (ending up two bytes before the start) we use an offset of 256–4, or 252. To jump back 128 bytes (to 126 bytes before the start) we use an offset of 256–128, or 128. This seems odd at first, but like most computer madness (K = K + 1?) it soon becomes second nature.

Let's say we wanted to write a program to do absolutely nothing. Unless we use a hardware approach (like turning the machine off), we can use a branch that jumps straight back where it came from. Since the branch itself is two bytes long, we need an offset of minus two. This gets stored as 256–2, or 254, so that the bytes:

<jump byte>
<254>

will leave the computer twiddling its thumbs forever.

Note for clever programmers: *what happens when the jump byte is 255? This corresponds to an offset of minus one, so that the computer jumps back into the middle of the jump instruction! Normally this is a disaster, but if you're programming a Z80 processor it has an interesting consequence. The byte 255, in the middle of the jump, represents an instruction called RST 56 — a one-byte instruction which tells the computer to make an immediate jump to location 56. Consequently, if the conditions are right for the jump, the computer goes directly to location 56 even if it's thousands of bytes away. So what you've got, quite by accident, is a conditional jump to location 56, all in two bytes! This isn't often useful, but it's interesting.*

'. . . it even questions it's own line decisions.'

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NETWORK NEWS

Peter Tootill and Steve Withers look at the differences between dumb and smart terminals, and give guidelines on buying terminal software.

One of the prerequisites for using your micro for telephone networking is the software that will turn it into a terminal (a terminal is basically an input and output device connected to a computer). In our case the terminal (the micro) will be connected via a telephone line, but the principle is the same as for the terminals directly connected to a mainframe computer. There are two types of terminal, 'dumb' and 'smart', and two types of micro terminal software.

Dumb terminal programs

A dumb terminal sends and receives characters; it has no ability to store or edit messages. Dumb terminal programs are simple and easy to write. All that's needed is a routine to convey what's typed on the keyboard through the RS232 port, and another to take what comes in through the RS232 port and display it on the micro screen (this can be done in Basic on most micros). Some micros permit you to use the RS232 port as if it were a file so that you can open it, print to it and read from it as you would a data file on cassette, for example.

Smart terminal programs

The main difference between a smart terminal and a dumb terminal is the former's ability to implement data to be transmitted. The terminal usually stores a certain amount for offline editing; some smart terminals are really dedicated micros with disk storage and comprehensive text editing facilities. Smart terminal software is the more complex, and is normally written in machine code or a suitably compiled high-level language such as 'C'. A Basic program is unlikely to be able to provide all the usual facilities.

What mainly turns dumb software into smart terminal software is the ability to store incoming data and transmit prepared files. It's preferable that the files be stored in such a way that the computer can load them later for use as programs. Smart terminal software is of limited use if it's the only program that can read and write the files it uses.

Many micros can load and save Basic programs in ASCII format, which means that they can easily be used as data files by other programs such as word processors and terminal software. Saving and loading data for offline use is just one feature of a good smart terminal program; others are as follows:

Up- and downloading of files and programs: it's necessary to make the distinction between files and programs, because not all smart terminal software can save a downloaded program in a format that can be used by the computer afterwards. Under the heading of 'Upload' is the transmission of prepared messages to a BBS, as the methods and principles are much the same. Good software should support several methods of up- and download including the popular Xmodem protocols.

X-on/X-off flow control: most online systems support this very useful method of stopping and starting the flow of data they are transmitting — it can be essential at fast data rates. Other methods of flow control do exist, but X-on/X-off is the most common.

Echo incoming data to printer: it's handy to be able to keep online a printed copy of what happens during a session.

Software control of RS232 settings: the ability to alter RS232 interface parameters from the terminal program can be important. Some systems use seven bits, even parity; others use eight bits and no parity, and so on. There are also systems using different baud rates, but some RS232 interfaces can't be controlled by software, so this feature isn't always possible.

Half-full-duplex and host echo: it's rare to find a modem with a half-duplex switch, so the software will have to stand-in if necessary. 'Half-duplex' is a method whereby onscreen characters are placed there locally rather than being echoed back from the computer at the other end of the phone line, which is the normal way of working. You may need this if you're communicating with other micros that are not running BBSs — if you're online to a friend exchanging programs, for example. 'Host echo' is what the BBS does when it sends back what you type, and is also useful for micro-micro communication.

Auto-log on and macro keys: some dial-up systems support an auto-log on feature. If your terminal software responds to this, it will save you having to type your name or account number each time you use the system.

Macro keys, or programmable function keys, can also come in handy. The programmable key can be set to a particular set of characters: for example, a mailbox number you call frequently. Press the function key and the number will be sent automatically.

Auto-dial: to use a modem with an auto-dial facility, you'll need the software to support it. The main problem is that auto-dial modems are rare as yet, and methods of operation vary. If you're buying, make sure that the modem and the software are compatible.

Translation tables: these are filters in which data is continuously monitored for certain characters which are then translated, or changed, into different characters. For example, if you're using a system that sends you ASCII code 08 for backspace and your computer uses ASCII code 127, you can set the translation table to change every 08 code it receives to 127, enabling a proper backspace on your screen and *vice versa.* Your printer may go haywire if certain codes appear in the data, so you can set up a table to filter out these codes when listing incoming data.

Another situation in which translation tables are essential is when using a micro (using ASCII codes) as a terminal to a system with EBCDIC codes, which many mainframes use. You can build ASCII to EBCDIC translation tables and convert the incoming and outgoing data to suit. In general use with BBSs translation tables are not essential, as in many cases the BBS software can be configured to suit your computer system.

Viewdata graphics: these use special code combinations to display coloured graphics on the user's terminal with only the normal seven-bit ASCII alphabet. If you plan to use Viatel or some other viewdata system and don't want to buy a separate software package, it's useful if your terminal software supports these codes. It's unusual to find terminal software that does both, although hopefully it will become more common.

Direct cursor addressing: you'll only need this feature in specialised applications. If you're using your micro as a terminal to a mainframe or database system, check that the machine supports this feature. If so, then you'll need to

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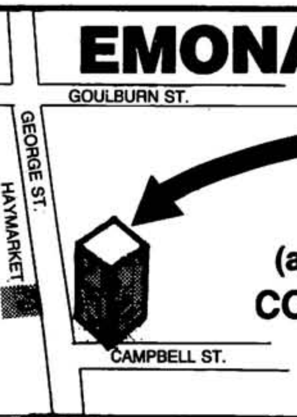

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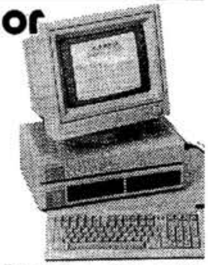

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Telephone: (08) 271 2043. Hours: 10am–10pm, weekends and public holidays. 9am–9pm weekdays.

Computer Ventures CBBS

Telephone: (08) 255 1946. System Operator: Daniel Schumacher. Hours: 24 hours daily.

Omen II

Telephone: (089) 27 4454. System Operator: Terry O'Brien. Hours: 24 hours daily.

Outback RCPM

Telephone: (089) 27 7111. System Operator: Phill Sampson. Hours: 24 hours daily.

OMEN III

Telephone: (09) 279 8555. System Operator: Greg Watkins. Hours: 24 hours daily.

New Zealand Systems

NZ Micro Club RBBS

Telephone: 0011 64 9 762 309. System Operator: Chris Cotton. Hours: 24 hours daily. Software up/downloading. Type "help" (in lower case) to log in.

Overseas systems

North America

SYSTEM	NUMBER	NOTES
SPACE Citadel	0011 1 206 839 4759	
Ckcms Citadel	0011 1 206 329 0436	
Eskimo North Minibin	0011 1 206 527 7638	
Conn-80	0011 1 212 441 3755	TRS-80 Color Computer
CLEO	0011 1 213 618 8800	Job vacancies
Mindstorm Network	0011 1 812 235 0908	Networked BBSs

EUROPE

SYSTEM	NUMBER	NOTES
ELFA ABC-MONITOR, Sweden	0011 468 730 0706	Half Duplex
ABC-Banken, Sweden	0011 463 511 0771	
ABC-MONITOR, Sweden	0011 468 801 523	Password required
CBBSD Gothenburg	0011 463 129 2160	75/1200 baud
CBBS Sweden*	0011 463 169 0754	
BUG, Sweden	0011 468 463 528	BBC Micro
XD-BBS Helsinki	0011 358 072 2272	
Commodore BBS, Finland	0011 358 116 223	
Tedas, Munich	0011 49 89 596 422	
Decates, Germany	0011 49 66 154 51433	

UK

SYSTEM	NUMBER	NOTES
CBBS South West	0011 44 626 890 014	
Liverpool Mailbox	0011 44 51 428 8924	
BASUG	0011 44 742 667 983	
Computer Answers	0011 44 1 631 3076	
CBBS Surrey	0011 44 4862 25174	
Blandford Board	0011 44 258 54494	
Microweb TBBS	0011 44 61 456 4157	BBC Micro
Stoke Information Technology Centre RCPM	0011 44 782 265 078	
Clinical Notes Online	0011 44 254 60339	

Africa

SYSTEM	NUMBER	NOTES
Connection 80, Cape Town	0011 27 21 457 750	
TRShop, Cape Town	0011 27 21 5367	
Clan Computers, Durban	0011 27 31 66356	
Peters Computers, Johannesburg	0011 27 11 834 5134	
Peters Computers, Johannesburg	0011 27 11 834 5135	
War Games, Johannesburg	0011 27 11 642 3722	

* After receiving the tone and connecting your modem, either type <C/R> or <COM C/R>. The system then asks for a password which is 'cbbs' in *lower-case* letters. If you only get a '>' from the system, it needs resetting, so type <I> C/R.

This information is correct and current to the best of our knowledge. Please send corrections and updates to: Steve Withers, C/- *Australian Personal Computer*, 77 Glenhuntly Road, Elwood, Victoria 3184.

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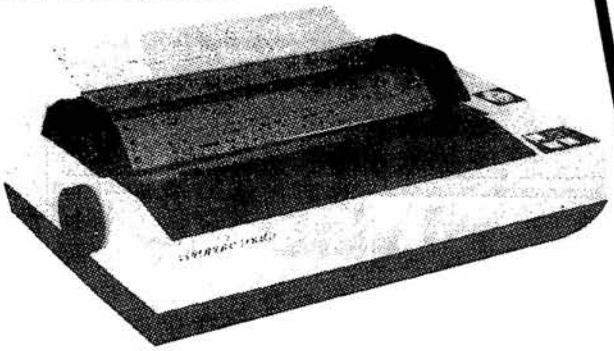

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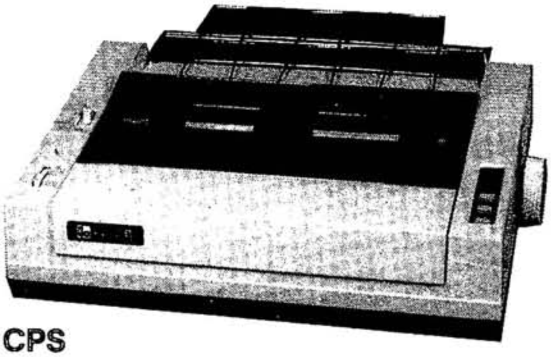

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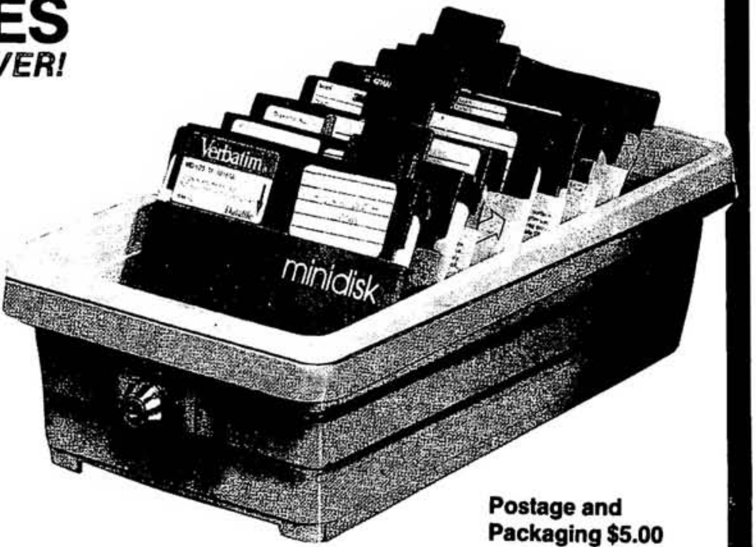

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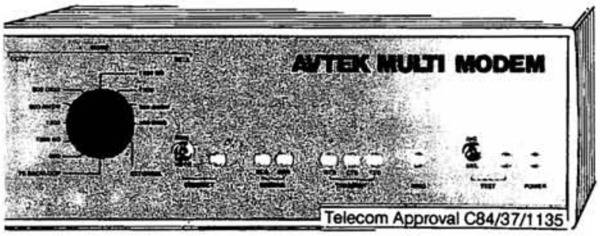

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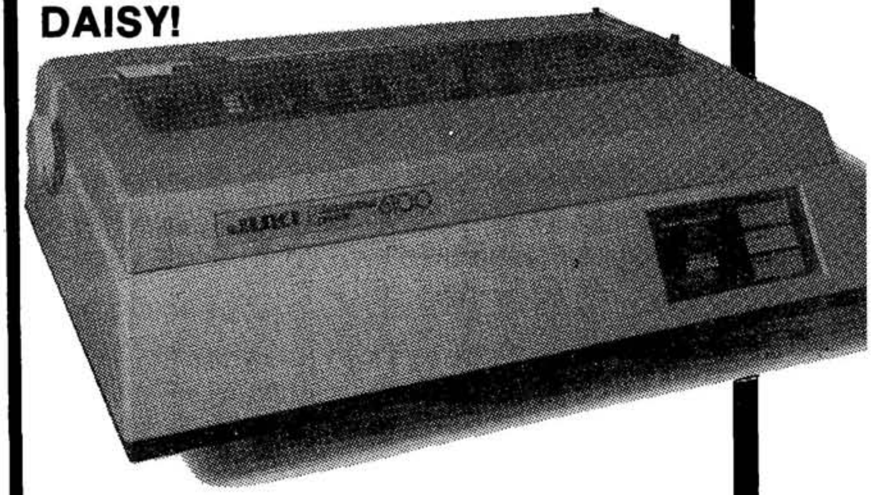

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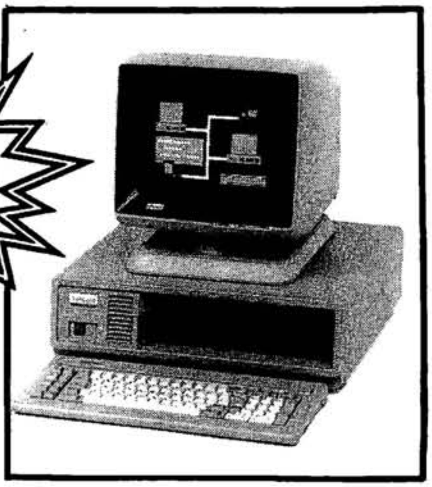

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choose a terminal program that supports the relevant mode (for example, VT52).

Conclusion

The number of terminal packages available is growing rapidly, and you're likely to find a confusing variety and price range for some micros. However, the price doesn't always reflect the quality or versatility of the software: some public domain programs are far better than many pricey commercial packages.

The best approach is to find a cheap, or preferably free, public domain program that you can use temporarily (users' groups are a good starting place). As you gain experience, you'll discover which features are essential and which are desirable. You can then look at the more expensive commercial packages and see which is the best value for money.

If you have a computer that's available in the US then that's the most likely source, or at least origin, of good terminal software. If your interest is in Viatel your best bet is to look to the UK for suitable software.

Modem Operating Frequencies

Modem Type	*Speed (Bit/s)*	*Duplex*	*Transmit Frequency 0 Hz*	*Transmit Frequency 1 Hz*	*Receive Frequency 0 Hz*	*Receive Frequency 1 Hz*	*Answer Tone Freq Hz*
CCITT V.21 Orig	<300	Full	1180	980	1850	1650	—
CCITT V.21 Ans	<300	Full	1850	1650	1180	980	2100
CCITT V.23 Mode 1	600	Half	1700	1300	1700	1300	2100
CCITT V.23 Mode 2	1200	Half	2100	1300	2100	1300	2100
CCITT V.23 Back	75	—	450	390	450	390	—
Bell 103 Orig	<300	Full	1070	1270	2025	2225	—
Bell 103 Ans	<300	Full	2025	2225	1070	1270	2225
Bell 202*	1200	Half	2200	1200	2200	1200	2025

** Bell 202 has no back channel as such, only a 5 bit/sec on/off signal (387Hz = on, no signal = off) used for handshaking. (CCITT V22 & Bell 212A do not use single frequencies like these and cannot be simply included in such a table.)*

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Australian systems

Micro Design Lab RCPM

Telephone: (02) 663 0150. System Operator: Stephen Jolly. Hours: 5pm–7am weekdays. 24 hours weekends.

MI Computer Club BBS

Telephone: (02) 662 1686. System Operator: Evan McHugh. Program downloading. Hours: 24 hours daily.

Sydney Public Access RCPM

Telephone: (02) 808 3536. System Operators: Barrie Hall and David Simpson. Membership required. Hours: 24 hours daily.

Prophet RBBS

Telephone: (02) 628 7030. Operator: Larry Lewis. Hours: 24 hours daily.

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OMEN I

Telephone: (02) 498 2495. System Operator: Ted Romer. Hours: 4.30pm–9am weekdays, 24 hours weekends.

ORACLE

Telephone: (02) 960 3641. System Operator: Rowan Evans. Hours: Midnight–8am weekdays, Midnight–6am weekends.

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Telephone: (02) 344 9511. Hours: 24 hours daily.

Dick Smith Electronics RIBM

Telephone: (02) 887 2276. System Operator: Ian Lindquist. Program downloading. 24 hours daily.

Sorcerer Users Group RCPM

Telephone: (02) 387 4439. System Operator: John Woolner. Hours 6pm–8am weekdays, 24 hours weekends. Ring back system.

Ausborne Users Group RCPM

Telephone: (02) 568 2791. System Operator: Milton McGlynn-Worthington. Hours: 24 hours daily.

Newcastle Microcomputer Club RCPM

Telephone: (049) 68 5385. System Operator: Tony Nicholson. Hours: 5pm–8.30am weekdays, 24 hours weekends.

Canberra RBBS

Telephone: (062) 88 8318. Hours: 24 hours daily.

MICOM RCPM CBBS

Telephone: (03) 762 5088. System Operator: Peter Jetson. Hours: 24 hours daily.

Sorcerer Computer Users Association CBBS

Telephone: (03) 434 3529. System Operator: David Woodberry. Program downloading for SCUA members. Hours: 24 hours daily.

PC Connection IBBS

Telephone: (03) 528 3750. System Operator: Lloyd Borrett. IBM PC program downloading. Hours: 24 hours daily.

Telebraille

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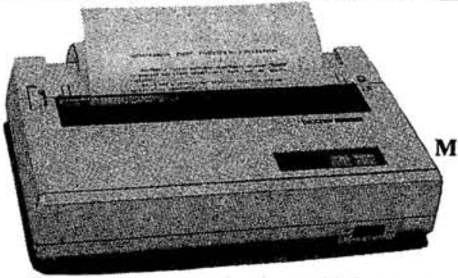

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USA	(Anaheim) COMDEX (Computer Conference and Exhibition). Contact: Interface Group Inc, 300 First Ave, Needham, MA 02194	March 21–24, 1985
Brisbane	Expo '85 Contact: Robert Woodland Exhibitions, 50 Sherbrook Rd, Acacia Ridge 4110 Telephone (07) 372 3380	March 28–30, 1985
Perth	Computers '85 Computer Exhibitions International, 190 Hay Street, East Perth 6000	May 1–4, 1985
USA	(Anaheim) COMDEX Contact: as for COMDEX, March 21–24	
Sydney	Data '85 Contact: Graphic Directions, 28 Foveaux Street, Surry Hills, 2010 (02) 212 4199	May 22–25, 1985
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Brain-teasers courtesy of J J Clessa.

Quickie

Their are three mistakes in this sentense — can you find them?

Prize Puzzle

This one should keep the micros humming for quite a while. I believe the puzzle was originated by Ernest Dudeney but it's certainly been around a while.

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For example, suppose the number is 2615. If you divide it by 5 and multiply it by 4 you get 2092. But if it were the number we were seeking, we would get 6152.

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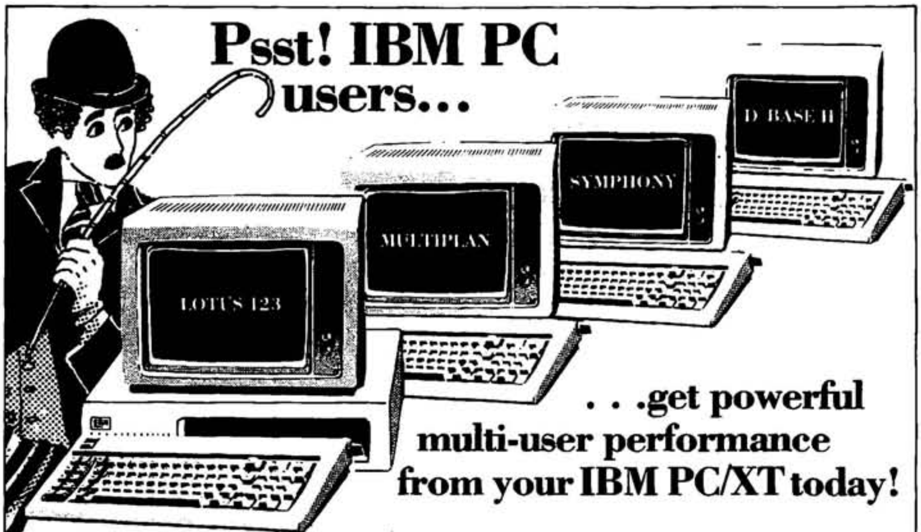

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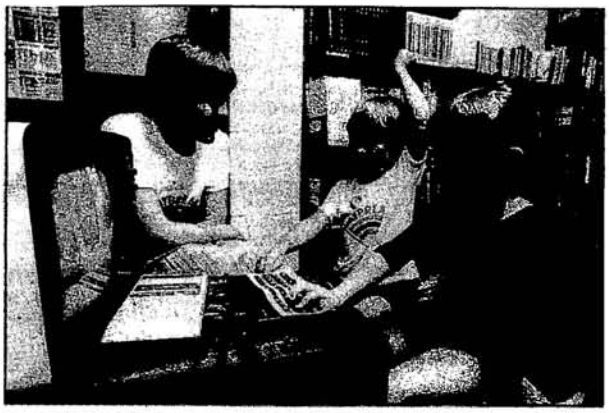

Apart from breaking into joy because the tape has finally loaded, what else might have excited the young user in the centre of this photograph? And no, we don't know why the other young lady had to put on her leotard before tackling the Spectrum.

Send your suggestions, on the back of a postcard, to Chip Chat, APC, *77 Glenhuntly Road, Elwood, Victoria 3184. Don't forget to give your name and address so we know where to send the $20 should you win. The closing date is 28 February 1985.*

Eat your heart out, Cindy: US software house Epyx has celebrated the 25th birthday of Barbie dolls by releasing a game based on this heroine of our times. The company president comments enthusiastically: 'Through the magic of the home computer, children can take Barbie shopping in five different stores, dress her in over 1000 combinations of outfits, and even change Barbie's hairstyle or hair colour. Readers concerned at this stereotyping will doubtless be reassured to learn of another feature at the Barbie convention where the game was announced — a display of 'contemporary Barbies groomed for the fast-paced business world.'

Power to the people: a recent A-Z of computer terminology pauses at 'terminal' to comment that it's 'a people-oriented device'. People-orienting — now that's just what this dictionary needs a lot more of.

Two sugars please: we can't wait to try the DeskSet desk organising package for the Mac. The one screenshot we've seen so far features a steaming cup in a prominent position on the manager's desk. Sadly, this option isn't available on the pull-down menu.

With friends like this . . . US magazine *Popular Computing* asked readers to vote for the most user-friendly piece of software. MacPaint came in a clear first. Second place was a tie between 'none' and 'there isn't any'. And one smart(ing) reader voted WordStar the hardest game to win.

Star-struck: one of our readers who visited the Las Vegas Comdex show is only just recovering. Playing bingo at breakfast and discovering dog biscuits shaped like postmen so put him off his stride that all his stories read like computer-generated poetry. Guy Kewney found it easier to resist the Las Vegas lifestyle.

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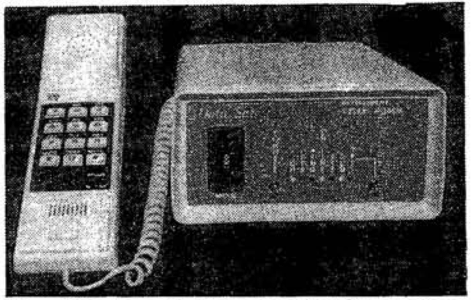

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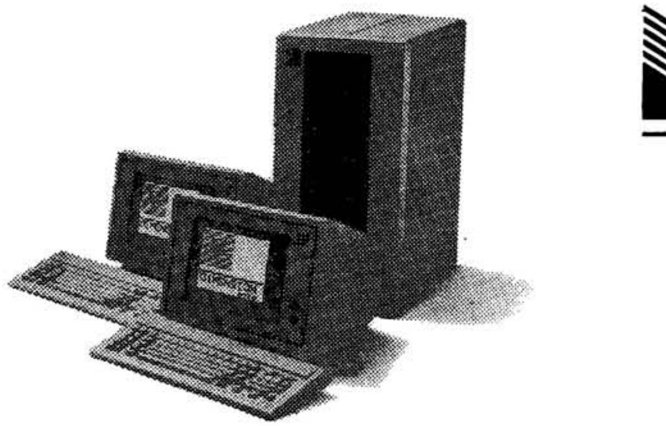

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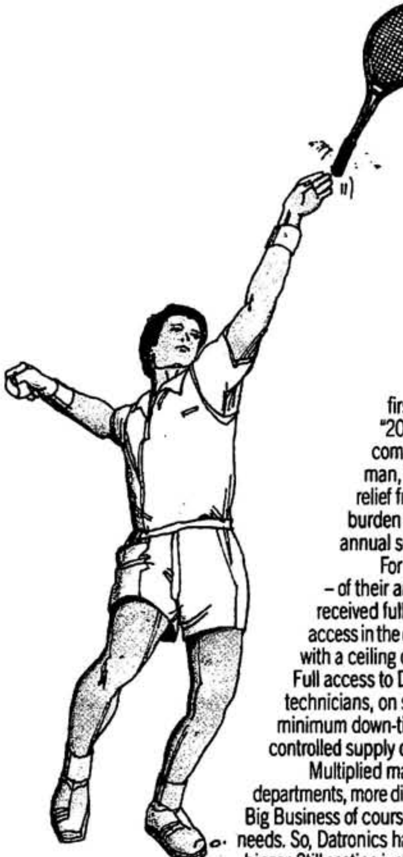

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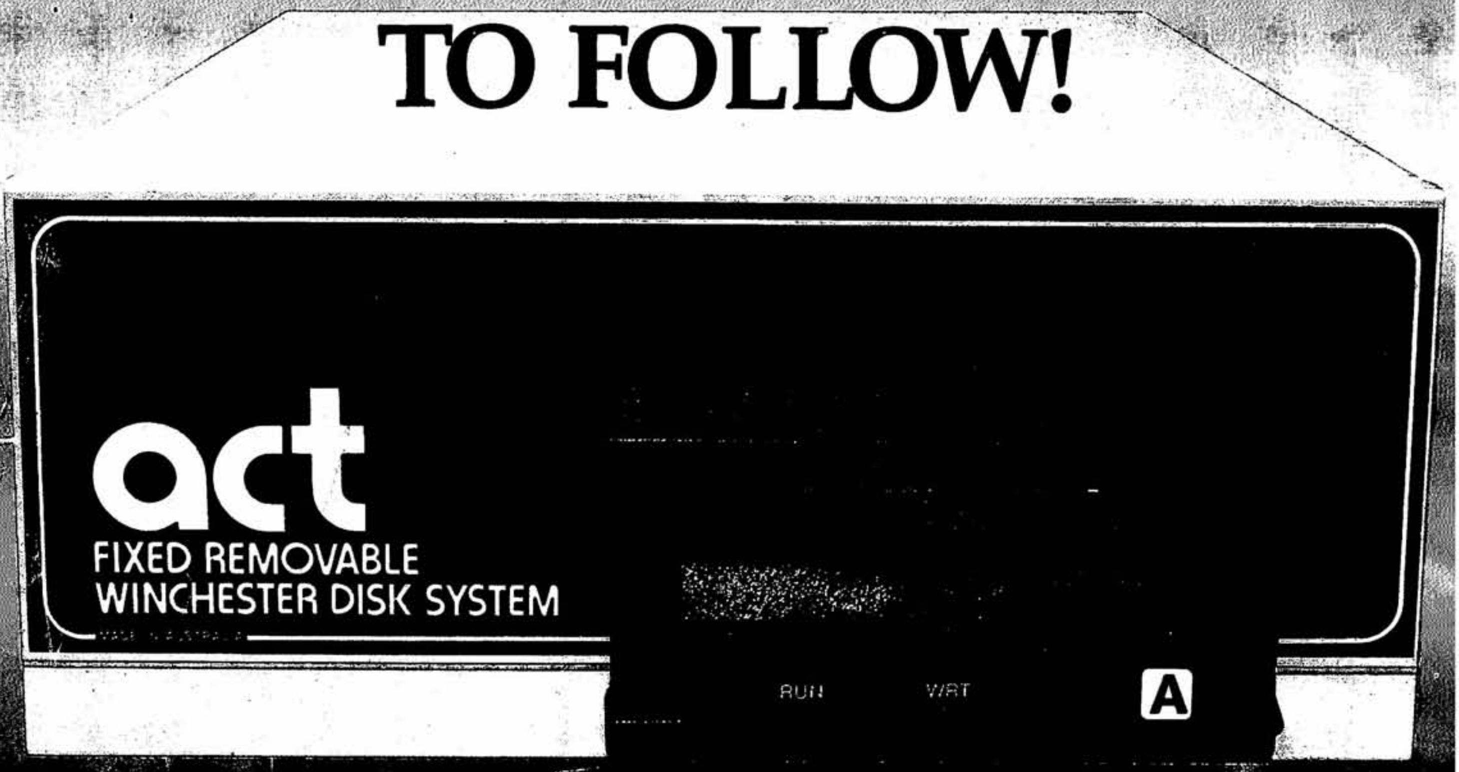

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